

Specification

Edexcel NVQ/competence-
based qualifications

Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF)

For first registration August 2010

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Authorised by Roger Beard
Prepared by Andres Vergara

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Qualification titles covered by this specification

This specification gives you the information you need to offer the Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF):

Qualification title	Qualification Accreditation Number (QAN)	Accreditation start date
Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF)	501/0747/1	01/08/2010

This qualification has been accredited within the Qualifications and Credit Framework (QCF) and is eligible for public funding as determined by the Department for Education (DfE) under Sections 96 and 97 of the Learning and Skills Act 2000.

The qualification title listed above features in the funding lists published annually by the DfE and the regularly updated website. It will also appear on the Learning Aims Database (LAD), where relevant.

You should use the QCF Qualification Accreditation Number (QAN), when you wish to seek public funding for your learners. Each unit within a qualification will also have a unique QCF reference number, which is listed in this specification.

The QCF qualification title and unit reference numbers will appear on the learners' final certification document. Learners need to be made aware of this when they are recruited by the centre and registered with Edexcel.

Key features of the Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF)

This qualification:

- is nationally recognised
- is based on the Semta National Occupational Standards (NOS). The NOS, Assessment Strategy and qualification structure are owned by Semta.

The Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF) has been approved as a component for the Semta Apprenticeship framework.

What is the purpose of this qualification?

This qualification is appropriate for employees in the engineering sector working across a broad range of areas. It is designed to assess occupational competence in the workplace where learners are required to demonstrate skills and knowledge to a level required in the engineering industry.

Who is this qualification for?

This qualification is for all learners aged 16 and above who are capable of reaching the required standards.

Edexcel's policy is that the qualification should:

- be free from any barriers that restrict access and progression
- ensure equality of opportunity for all wishing to access the qualification.

What are the benefits of this qualification to the learner and employer?

This qualification allows learners to demonstrate competence against National Occupational Standards which are based on the needs of the engineering industry as defined by Semta, the Sector Skills Council. As such it contributes to the development of skilled labour in the sector. The qualification may contribute towards the competence element of an Apprenticeship.

What are the potential job roles for those working towards this qualification?

- Electrical engineering technician
- Electronic engineering technician
- Energy and environmental engineering technician
- Engineering maintenance fitter
- Engineering maintenance technician
- Engineering operative
- Heating and ventilating engineer.

What progression opportunities are available to learners who achieve this qualification?

This qualification allows learners to demonstrate competence in installation and commissioning at a level required by the engineering industry. Learners can progress across the level and size of the engineering competence and knowledge qualifications and into other occupational areas such as team leading and management.

Further information is available in *Annexe A*.

What is the qualification structure for the Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF)?

Individual units can be found in the *Units* section. The QCF level and credit value are given on the first page of each unit.

To achieve the Edexcel Level 3 NVQ Diploma in Installation and Commissioning (QCF) learners must complete a minimum of 149 credits. Learners must complete all mandatory units in Group M (35 credits) and then choose one of the following pathways.

Edexcel Level 3 NVQ Diploma in Installation and Commissioning – Equipment Installation (QCF)

Learners must complete a minimum of one unit in Group AO for a minimum total of 149 credits.

Edexcel Level 3 NVQ Diploma in Installation and Commissioning – Commissioning (QCF)

Learners must complete a minimum of one unit in Group BO for a minimum total of 149 credits.

Edexcel Level 3 NVQ Diploma in Installation and Commissioning – Traction Lift Installation (QCF)

Learners must complete all units in Group CM for a minimum total of 233 credits.

Edexcel Level 3 NVQ Diploma in Installation and Commissioning – Hydraulic Lift Installation (QCF)

Learners must complete all units in Group DM for a minimum total of 233 credits.

Edexcel Level 3 NVQ Diploma in Installation and Commissioning – Escalator Installation and Commissioning (QCF)

Learners must complete all units in Group EM for a minimum total of 218 credits.

M – mandatory units (all pathways)

Learners must complete all units in Group M.

Credit value required: minimum 35.

D/601/0547 – Handing over and confirming completion of installation or commissioning activities

A/601/5013 – Complying with statutory regulations and organisational safety requirements

Y/601/5102 – Using and interpreting engineering data and documentation

K/601/5055 – Working efficiently and effectively in engineering

A – Equipment Installation (pathway)

Learners must complete a minimum of one unit in Group AO.

AO – optional units (Equipment Installation)

Credit value required: minimum 114.

K/601/0549 – Installing mechanical equipment

D/601/0550 – Installing electrical/electronic equipment

M/601/0553 – Installing equipment to produce an engineered system

A/601/0555 – Installing instrumentation and control equipment

J/601/0557 – Installing fluid power equipment

L/601/0558 – Installing process controller equipment

R/601/0559 – Installing emergency electrical power generation equipment

J/601/0560 – Installing environmental pollution control equipment

L/601/0561 – Installing workplace environmental control equipment

R/601/0562 – Installing heating and ventilation equipment

D/601/0564 – Installing air conditioning and ventilation equipment

H/601/0565 – Installing compressed air equipment

K/601/0566 – Installing waste/foul water distribution equipment

M/601/0567 – Installing fresh water distribution equipment

A/601/0572 – Installing refrigeration equipment

B – Commissioning (pathway)

Learners must complete a minimum of one unit in Group BO.

BO – optional units (Commissioning)

Credit value required: minimum 114.

F/601/0573 – Commissioning mechanical equipment and systems

J/601/0574 – Commissioning electrical/electronic equipment and systems

L/601/0575 – Commissioning engineered systems

R/601/0576 – Commissioning process controller equipment and systems

- R/601/0626 – Commissioning instrumentation and control equipment and systems
- Y/601/0627 – Commissioning fluid power equipment and systems
- D/601/0628 – Commissioning emergency electrical power generation equipment and systems
- D/601/0631 – Commissioning environmental pollution control equipment and systems
- H/601/0632 – Commissioning workplace environmental control equipment and systems
- J/601/0638 – Commissioning heating and ventilation equipment and systems
- L/601/0642 – Commissioning air conditioning and ventilation equipment and systems
- Y/601/0644 – Commissioning compressed air equipment and systems
- K/601/0650 – Commissioning waste/foul water distribution equipment and systems
- F/601/0654 – Commissioning fresh water distribution equipment and systems
- Y/601/0658 – Commissioning refrigeration equipment and systems

C – Traction Lift Installation (pathway)

Learners must complete all units in Group CM.

CM – mandatory units (Traction Lift Installation)

Credit value required: minimum 198.

- R/601/0660 – Carrying out fault diagnosis on lift installations
- M/601/0665 – Measuring and setting out lift installations
- A/601/0667 – Installing lift well and ancillary equipment
- F/601/0668 – Installing traction lift equipment
- J/601/0669 – Installing lift ropes and chains
- J/601/0672 – Installing lift doors, frames and ancillary components
- L/601/0673 – Checking and setting lift installations

D – Hydraulic Lift Installation (pathway)

Learners must complete all units in Group DM.

DM – mandatory units (Hydraulic Lift Installation)

Credit value required: minimum 198.

- R/601/0660 – Carrying out fault diagnosis on lift installations
- M/601/0665 – Measuring and setting out lift installations
- A/601/0667 – Installing lift well and ancillary equipment

J/601/0669 – Installing lift ropes and chains

J/601/0672 – Installing lift doors, frames and ancillary components

L/601/0673 – Checking and setting lift installations

R/601/0674 – Installing hydraulic lift equipment

E – Escalator Installation and Commissioning (pathway)

Learners must complete all units in Group EM.

EM – mandatory units (Escalator Installation and Commissioning)

Credit value required: minimum 183.

H/601/0677 – Carrying out fault diagnosis on escalator installations

H/601/0680 – Installing escalator equipment

A/601/0684 – Commissioning escalator installations

How is the qualification graded and assessed?

The overall grade for the qualification is a 'pass'. The learner must achieve all the required units within the specified qualification structure.

To pass a unit the learner must:

- achieve **all** the specified learning outcomes
- satisfy **all** the assessment criteria by providing sufficient and valid evidence for each criterion
- show that the evidence is their own.

The qualification is designed to be assessed:

- in the workplace or
- in conditions resembling the workplace, as specified in the Assessment Strategy for the sector, or
- as part of a training programme.

Assessment Requirements/Strategy

The Assessment Strategy for this qualification has been included in *Annexe E*. It has been developed by Semta in partnership with employers, training providers, awarding organisations and the regulatory authorities. The assessment strategy includes details on:

- criteria for defining realistic working environments
- roles and occupational competence of assessors, expert witnesses, internal verifiers and standards verifiers
- quality control of assessment
- evidence requirements.

Evidence of competence may come from:

- **current practice** where evidence is generated from a current job role
- a **programme of development** where evidence comes from assessment opportunities built into a learning/training programme whether at or away from the workplace
- the **Recognition of Prior Learning (RPL)** where a learner can demonstrate that they can meet the assessment criteria within a unit through knowledge, understanding or skills they already possess without undertaking a course of learning. They must submit sufficient, reliable and valid evidence for internal and standards verification purposes. RPL is acceptable for accrediting a unit, several units or a whole qualification
- a **combination** of these.

It is important that the evidence is:

Valid	relevant to the standards for which competence is claimed
Authentic	produced by the learner
Current	sufficiently recent to create confidence that the same skill, understanding or knowledge persist at the time of the claim
Reliable	indicates that the learner can consistently perform at this level
Sufficient	fully meets the requirements of the standards.

Types of evidence

To successfully achieve a unit the learner must gather evidence which shows that they have met the required standard in the assessment criteria. Evidence can take a variety of different forms including the following examples:

- direct observation of the learner's performance by their assessor
- outcomes from oral or written questioning
- products of the learner's work
- personal statements and/or reflective accounts
- outcomes from simulation, where permitted by the assessment strategy
- professional discussion
- assignment, project/case studies
- authentic statements/witness testimony
- expert witness testimony
- reflective accounts
- evidence of Recognition of Prior Learning.

Learners can use one piece of evidence to prove their knowledge, skills and understanding across different assessment criteria and/or across different units. It is, therefore, not necessary for learners to have each assessment criterion assessed separately. Learners should be encouraged to reference the assessment criteria to which the evidence relates.

Evidence must be made available to the assessor, internal verifier and Edexcel standards verifier. A range of recording documents is available on the Edexcel website www.edexcel.com. Alternatively, centres may develop their own.

Additional requirements

The Joint Awarding Body and the SSC Working Practices Group have identified additional requirements that are needed to assess and quality assure qualifications placed on the QCF that use NVQ within their title. These requirements are shown in *Annexe D: Additional requirements for qualifications that use the title NVQ within the QCF*.

Centre recognition and approval

Centre recognition

Centres that have not previously offered Edexcel qualifications need to apply for and be granted centre recognition as part of the process for approval to offer individual qualifications. New centres must complete both a centre recognition approval application and a qualification approval application.

Existing centres will be given 'automatic approval' for a new qualification if they are already approved for a qualification that is being replaced by the new qualification and the conditions for automatic approval are met. Centres already holding Edexcel approval are able to gain qualification approval for a different level or different sector via Edexcel online.

Approvals agreement

All centres are required to enter into an approvals agreement which is a formal commitment by the head or principal of a centre to meet all the requirements of the specification and any linked codes or regulations. Edexcel will act to protect the integrity of the awarding of qualifications, if centres do not comply with the agreement. This could result in the suspension of certification or withdrawal of approval.

Quality assurance

Detailed information on Edexcel's quality assurance processes is given in *Annexe B*.

What resources are required?

Each qualification is designed to support learners working in the Engineering sector. Physical resources need to support the delivery of the qualification and the assessment of the learning outcomes and must be of industry standard. Centres must meet any specific resource requirements outlined in *Annexe E: Assessment Requirements Strategy*. Staff assessing the learner must meet the requirements within the overarching assessment strategy for the sector.

Unit format

Each unit in this specification contains the following sections.

Unit title:					The unit title is accredited on the QCF and this form of words will appear on the learner's Notification of Performance (NOP).
Unit reference number:					This code is a unique reference number for the unit.
QCF level:					All units and qualifications within the QCF have a level assigned to them, which represents the level of achievement. There are nine levels of achievement, from Entry level to level 8. The level of the unit has been informed by the QCF level descriptors and, where appropriate, the NOS and/or other sector/professional.
Credit value:					All units have a credit value. The minimum credit value is one, and credits can only be awarded in whole numbers. Learners will be awarded credits when they achieve the unit.
Guided learning hours:					A notional measure of the substance of a qualification. It includes an estimate of the time that might be allocated to direct teaching or instruction, together with other structured learning time, such as directed assignments, assessments on the job or supported individual study and practice. It excludes learner-initiated private study.
Unit summary:					This provides a summary of the purpose of the unit.
Assessment requirements/evidence requirements:					The assessment/evidence requirements are determined by the SSC. Learners must provide evidence for each of the requirements stated in this section.
Assessment methodology:					This provides a summary of the assessment methodology to be used for the unit.
Learning outcomes:	Assessment criteria:	Evidence type:	Portfolio reference:	Date:	
			The learner should use this box to indicate where the evidence can be obtained eg portfolio page number.	The learner should give the date when the evidence has been provided.	
Learning outcomes state exactly what a learner should know, understand or be able to do as a result of completing a unit.		The assessment criteria of a unit specify the standard a learner is expected to meet to demonstrate that a learning outcome, or a set of learning outcomes, has been achieved.		Learners must reference the type of evidence they have and where it is available for quality assurance purposes. The learner can enter the relevant key and a reference. Alternatively, the learner and/or centre can devise their own referencing system.	

Units

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Hand over and confirm completion of installation or commissioning activities</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 confirm that the equipment is ready for handover, by carrying out all of the following checks, as applicable to the equipment being handed over:</p> <ul style="list-style-type: none"> - the installation and/or commissioning activity has been completed and the equipment functions to specification - all safety systems are functioning correctly - any waste materials, safety barriers and warning signs used specifically for installation/commissioning activities have been removed - any auxiliary systems or equipment involved are connected and operable - environmental controls are operable - others involved in using the equipment are aware of impending start-up/handover 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out all of the following during the handover procedures:</p> <ul style="list-style-type: none"> - run the installed and/or commissioned equipment through a complete cycle, in the presence of the appropriate person - confirm that the other person accepts that the equipment functions satisfactorily, to specification - highlight to the appropriate person any modifications or unusual features in the operating procedure - hand over all documentation relating to operating instructions, service/maintenance requirements - obtain agreement from the other person that they now accept responsibility for the equipment being handed over - complete any necessary handover documentation - confirm that the other person knows who to contact, and how, for future maintenance requirements 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.4 carry out the correct handover procedures for one type of equipment/service from the following:</p> <ul style="list-style-type: none"> - manual - semi-automatic - fully automatic - process/control - computer controlled - engineering services - other specific equipment <p>1.5 confirm that everyone involved accepts the product or asset is in a satisfactory condition for handover to take place</p> <p>1.6 clearly identify any unusual features of the condition of the product or asset.</p>			
<p>1b Hand over and confirm completion of installation or commissioning activities (continued)</p>	<p>1.7 make the handover and obtain agreement between everyone involved on the precise moment of transfer of responsibility</p> <p>1.8 carry out handover procedures to one of the following people:</p> <ul style="list-style-type: none"> - commissioning engineer - production/process supervisor - maintenance supervisor - other specific person 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 deal promptly and effectively with problems within their control and report those that they cannot solve</p> <p>1.10 make sure that clear, accurate and complete records of the handover are made</p> <p>1.11 complete all relevant paperwork from the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - job card - installation report - commissioning report - other handover paperwork. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to hand over and confirm completion of installation or commissioning activities</p>	<p>2.1 explain the health and safety requirements of the area in which the handover is to take place, and the responsibility they place on them</p> <p>2.2 describe the isolation and lock-off procedure or permit-to-work procedure that applies to the equipment being installed/commissioned</p> <p>2.3 explain the specific health and safety precautions to be applied during the handover procedure, and their effects on others</p> <p>2.4 explain the importance of wearing protective clothing and other appropriate safety equipment during the handover, and where it may be obtained</p> <p>2.5 describe the checking process to be followed before handing over the equipment (eg, are the safety and quality systems operable, does the equipment function to specification, run rate)</p> <p>2.6 explain the appropriate handover procedure, depending on the activity carried out (installation, commissioning)</p> <p>2.7 explain the procedure for involving the appropriate people when starting up the equipment during the handover</p> <p>2.8 explain the need to highlight any unusual or changed operating features of the equipment.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to hand over and confirm completion of installation or commissioning activities (continued)</p>	<p>2.9 explain the importance of informing the appropriate person of any future maintenance requirements</p> <p>2.10 explain the need to confirm that the other person understands the equipment operating procedures</p> <p>2.11 explain the need to ensure that the person they are handing over the equipment to accepts that it is functioning correctly</p> <p>2.12 explain what organisational documentation procedures are applicable to the handover</p> <p>2.13 explain how to create and maintain effective working relationships with appropriate people (encouraging, helping, politeness, open discussions both ways)</p> <p>2.14 describe the problems that can occur during handover, and explain how they can be overcome</p> <p>2.15 describe the extent of their own authority, and explain whom they should report to if they have problems that they cannot resolve.</p>			

Learner name: _____ Date: _____
Learner signature: _____ Date: _____
Assessor signature: _____ Date: _____
Internal verifier signature: _____ Date: _____
(if sampled)

Unit 2: Complying with statutory regulations and organisational safety requirements

Unit reference number: A/601/5013

QCF level: 2

Credit value: 5

Guided learning hours: 35

Unit summary

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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Sema Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1 Comply with statutory regulations and organisational safety requirements</p>	<p>1.1 comply with their duties and obligations as defined in the Health and Safety at Work Act</p> <p>1.2 demonstrate their understanding of their duties and obligations to health and safety by:</p> <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> • 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 <p>1.3 present themselves in the workplace suitably prepared for the activities to be undertaken</p> <p>1.4 follow organisational accident and emergency procedures</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.5 comply with emergency requirements, to include:</p> <ul style="list-style-type: none"> - 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 <p>1.6 recognise and control hazards in the workplace</p> <p>1.7 identify the hazards and risks that are associated with the following:</p> <ul style="list-style-type: none"> - 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 <p>1.7 use correct manual lifting and carrying techniques</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 demonstrate one of the following methods of manual lifting and carrying:</p> <ul style="list-style-type: none"> - lifting alone - with assistance of others - with mechanical assistance <p>1.9 apply safe working practices and procedures to include:</p> <ul style="list-style-type: none"> - 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. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2 Know how to comply with statutory regulations and organisational safety requirements</p>	<p>2.1 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)</p> <p>2.2 describe the specific regulations and safe working practices and procedures that apply to their work activities</p> <p>2.3 describe the warning signs for the seven main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations</p> <p>2.4 explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.5 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)</p> <p>2.6 describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace</p> <p>2.7 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)</p> <p>2.8 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)</p> <p>2.9 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</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.10 explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured</p> <p>2.11 describe the procedures for sounding the emergency alarms, evacuation procedures and escape routes to be used, and the need to report their presence at the appropriate assembly point</p> <p>2.12 describe the organisational policy with regard to fire fighting procedures; the common causes of fire and what they can do to help prevent them</p> <p>2.13 describe the protective clothing and equipment that is available for their areas of activity</p> <p>2.14 explain how to safely lift and carry loads, and the manual and mechanical aids available</p> <p>2.15 explain how to prepare and maintain safe working areas; the standards and procedures to ensure good housekeeping</p> <p>2.16 describe the importance of safe storage of tools, equipment, materials and products</p> <p>2.17 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve.</p>			

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Unit 3: Using and interpreting engineering data and documentation

Unit reference number: Y/601/5102

QCF level: 2

Credit value: 5

Guided learning hours: 25

Unit summary

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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1 Use and interpret engineering data and documentation</p>	<p>1.1 use the approved source to obtain the required data and documentation</p> <p>1.2 use the data and documentation and carry out all of the following:</p> <ul style="list-style-type: none"> - 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 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 correctly identify, interpret and extract the required information</p> <p>1.4 extract information that includes three of the following:</p> <ul style="list-style-type: none"> - 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 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - 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 			
1.5	use the information obtained to ensure that work output meets the specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use information extracted from documents to include one from the following:</p> <ul style="list-style-type: none"> - 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 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use information extracted from related documentation, to include two from the following:</p> <ul style="list-style-type: none"> - 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 <p>1.8 deal promptly and effectively with any problems within their control and report those which cannot be solved</p> <p>1.9 report any inaccuracies or discrepancies in documentation and specifications.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2 Know how to use and interpret engineering data and documentation</p>	<p>2.1 explain what information sources are used for the data and documentation that they use in their work activities</p> <p>2.2 explain how documents are obtained, and how to check that they are current and valid</p> <p>2.3 explain the basic principles of confidentiality (including what information should be available and to whom)</p> <p>2.4 describe the different ways/formats that data and documentation can be presented (such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)</p> <p>2.5 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)</p> <p>2.6 describe the importance of differentiating fact from opinion when reviewing data and documentation</p> <p>2.7 describe the importance of analysing all available data and documentation before decisions are made</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the different ways of storing and organising data and documentation to ensure easy access</p> <p>2.9 describe the procedures for reporting discrepancies in the data or documentation, and for reporting lost or damaged documents</p> <p>2.10 describe the importance of keeping all data and documentation up to date during the work activity, and the implications of this not being done</p> <p>2.11 explain the care and control procedures for the documents, and how damage or graffiti on documents can lead to scrapped work</p> <p>2.12 explain the importance of returning documents to the designated location on completion of the work activities</p> <p>2.13 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)</p> <p>2.14 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)</p> <p>2.15 explain the imperial and metric systems of measurement; tolerancing and fixed reference points</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.16 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)</p> <p>2.17 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.</p>			

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Unit 4: Working efficiently and effectively in engineering

Unit reference number: K/601/5055

QCF level: 3

Credit value: 5

Guided learning hours: 25

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, 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 that any tools, equipment, materials and other resources required are available and in a safe and usable condition.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1 Work efficiently and effectively in engineering</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 prepare the work area to carry out the engineering activity</p> <p>1.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken:</p> <ul style="list-style-type: none"> - the work area is free from hazards and is 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 usable condition - all necessary drawings, specifications and associated documentation is obtained - job instructions are obtained and understood - the correct materials or components are obtained 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - storage arrangements for work are appropriate - appropriate authorisation to carry out the work is obtained <p>1.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements</p> <p>1.5 ensure that completed products or resources are stored in the appropriate location on completion of the activities</p> <p>1.6 complete work activities, to include all of the following:</p> <ul style="list-style-type: none"> - completing all necessary documentation accurately and legibly - returning tools and equipment - returning drawings and work instructions - identifying, where appropriate, any unusable tools, equipment or components - arranging for disposal of waste materials <p>1.7 tidy up the work area on completion of the engineering activity</p> <p>1.8 deal promptly and effectively with problems within their control and report those that cannot be resolved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 deal with problems affecting the engineering process, to include two of the following</p> <ul style="list-style-type: none"> - materials - tools and equipment - drawings - job specification - quality - people - timescales - safety - activities or procedures <p>1.10 contribute to and communicate opportunities for improvement to working practices and procedures</p> <p>1.11 make recommendations for improving two of the following:</p> <ul style="list-style-type: none"> - working practices - working methods - quality - safety - tools and equipment - supplier relationships - internal communication 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - customer service - training and development - teamwork - other <p>1.12 maintain effective working relationships with colleagues to include two of the following:</p> <ul style="list-style-type: none"> - colleagues within own working group - colleagues outside normal working group - line management - external contacts <p>1.13 review personal training and development as appropriate to the job role</p> <p>1.14 review personal development objectives and targets to include one of the following:</p> <ul style="list-style-type: none"> - dual or multi-skilling - training on new equipment/technology - increased responsibility - understanding of company working practices, procedures, plans and policies - other specific requirements. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2 Know how to work efficiently and effectively in engineering</p>	<p>2.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work area</p> <p>2.2 describe the correct use of any equipment used to protect the health and safety of themselves and their colleagues</p> <p>2.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity</p> <p>2.4 describe the action that should be taken if documentation received is incomplete and/or incorrect</p> <p>2.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity</p> <p>2.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity</p> <p>2.7 describe the action that should be taken if tools and equipment are not in full working order</p> <p>2.8 describe the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity</p> <p>2.9 describe the action that should be taken if materials do not meet the requirements of the activity</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.10 explain whom to inform when the work activity has been completed</p> <p>2.11 describe the information and/or documentation required to confirm that the activity has been completed</p> <p>2.12 explain what materials, equipment and tools can be reused</p> <p>2.13 explain how any waste materials and/or products are transferred, stored and disposed of</p> <p>2.14 explain where tools and equipment should be stored and located</p> <p>2.15 describe the importance of making recommendations for improving working practices</p> <p>2.16 describe the procedure and format for making suggestions for improvements</p> <p>2.17 describe the benefits to organisations if improvements can be identified</p> <p>2.18 describe the importance of maintaining effective working relationships within the workplace</p> <p>2.19 describe the procedures to deal with and report any problems that can affect working relationships</p> <p>2.20 describe the difficulties that can occur in working relationships</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.21 describe the regulations that affect how they should be treated at work (such as Equal Opportunities Act, Race and Sex Discrimination, Working Time Directive)</p> <p>2.22 describe the benefits of continuous personal development</p> <p>2.23 describe the training opportunities that are available in the workplace</p> <p>2.24 describe the importance of reviewing their training and development</p> <p>2.25 explain with whom to discuss training and development issues</p> <p>2.26 describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.</p>			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install mechanical equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure safe isolation of services during the installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 move and position equipment, using two of the following:</p> <ul style="list-style-type: none"> - slings - cranes - fork lift - portable lifting devices - block and tackle - rollers/skates - hoists - jacks - manual handling and moving loads <p>1.7 use three of the following instruments during the installation activities:</p> <ul style="list-style-type: none"> - straight edges and feeler gauges - engineer's levels - dial test indicators - measuring instruments (such as electrical, mechanical, fluid power) - plumb lines and taut wires - alignment telescopes - laser equipment - self-diagnosis equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install, position and secure the equipment and components in accordance with the specification</p> <p>1.9 install one of the following types of mechanical equipment:</p> <ul style="list-style-type: none"> - machine tools - industrial compressors - conveyors - turbines - elevators - processing plant - hoppers or large storage vessels - lifting and handling equipment - other equipment (specify) - engines - process control equipment (such as large valves and actuating mechanisms, pumps). 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install mechanical equipment (continued)	<p>1.10 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - fitting inserts (such as rag or expanding bolts) - positioning equipment - aligning equipment - levelling equipment - shimming and packing - fitting anti-vibration mountings - securing using mechanical fixings - applying screw fastening locking devices <p>1.11 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - utility service connections (such as gas, air, water, oil) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 check that all necessary connections to the equipment are complete</p> <p>1.13 carry out checks and adjustments, appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - testing that the equipment operates to the installation specification <p>plus six more of the following:</p> <ul style="list-style-type: none"> - setting working clearance - tensioning - topping up fluid/oil reservoirs - making `off-load` checks - checking level and alignment - pressurising the system - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction - checking torque settings of fasteners - ensuring locking devices are fitted to fasteners (where appropriate) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.15 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.17 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.18 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operation specification/range - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.19 complete the relevant paperwork, to include one of the following, and pass to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install mechanical equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing mechanical equipment, (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing mechanical equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks of the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning of the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.11 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)</p> <p>2.12 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>2.13 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.14 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineer's levels, alignment telescopes and laser devices).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install mechanical equipment (continued)</p>	<p>2.15 describe the techniques used to position, align, level and adjust the equipment</p> <p>2.16 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.17 explain how to connect mechanical power transmission devices (such as belt and chain drives, couplings, clutches and brakes)</p> <p>2.18 explain how to connect the equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)</p> <p>2.19 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.20 describe the procedure for the safe disposal of waste materials</p> <p>2.21 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)</p> <p>2.22 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.23 explain 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</p> <p>2.24 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.25 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.26 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.27 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.28 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install electrical/electronic equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris - apply procedures and precautions to eliminate electrostatic discharge hazards 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use two of the following test instruments during the installation activities:</p> <ul style="list-style-type: none"> - multimeter - watt meter - voltmeter - ammeter - insulation resistance tester - light meter - earth-loop impedance tester - other specific test equipment <p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install ten of the following electrical module/components:</p> <ul style="list-style-type: none"> - switchgear - alarm devices - programmable controllers - power factor correction devices - motors and starters - luminaries - panels or sub-assemblies - control devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - communication equipment - cable connectors - encoders or resolvers - conduit - bus bars - safety devices - emergency/standby batteries - overload protection devices - sensors and actuators - electronic modules/units - trunking - tray work - other electrical equipment (specify) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 apply installation methods and techniques to include four of the following:</p> <ul style="list-style-type: none"> - marking out of location positions for components/modules - positioning and securing of equipment and components - securing by using mechanical fixings - securing by using masonry fixings - drilling and hole preparation - levelling and alignment <p>1.10 install three of the following types of cables:</p> <ul style="list-style-type: none"> - mineral - armoured - data/communication - fibre optics - PVC - screened - wiring loom/harness. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install electrical/electronic equipment (continued)	<p>1.11 carry out six of the following cable termination activities:</p> <ul style="list-style-type: none"> - terminating armoured cables - terminating mineral cables - sealing and protecting cable connections - making mechanical/screwed/clamped connections - soldering and de-soldering - attaching suitable cable identification - route and secure wires and cables - heat shrinking (devices and boots) - crimping (such as tags and pins) - stripping cable insulation/protection - adding cable end fittings <p>1.12 connect equipment to two of the following types of electrical supplies:</p> <ul style="list-style-type: none"> - single phase - combination power circuits - three phase - direct current - low voltage (up to 115V) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 carry out checks and adjustments, appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - testing that the equipment operates to the installation specification <p>plus six more from the following:</p> <ul style="list-style-type: none"> - protective resistance values - insulation resistance values - voltage levels - load current - power rating - resistance - capacitance - frequency values - continuity - inductance - safety device trip speed - polarity - making visual checks for completeness and freedom from damage 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - making sensory checks (sight, sound, smell) - specialised tests (such as speed, sound, light, temperature) <p>1.15 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.16 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.17 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.18 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.19 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operation range - BS 7671/IEE wiring regulations - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.20 complete the relevant paperwork, to include one of the following, and pass to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install electrical/electronic equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing electrical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing electrical equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, IEE regulations, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain the basic principles of operation of the equipment/circuits being installed, and the purpose of individual modules/components</p> <p>2.9 describe the different types of cabling and their application (such as multicore cables, single core cables, steel wire armoured (SWA), mineral insulated (MI), screened cables, data/communications cables, fibre optics)</p> <p>2.10 describe the different types of electric motors and motor starters</p> <p>2.11 describe the different types of control systems and their various components</p> <p>2.12 explain the application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)</p> <p>2.13 describe the various lighting systems used (including tungsten, sodium, mercury vapour and fluorescent)</p> <p>2.14 describe the different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)</p> <p>2.15 explain the application of ohmmeters, multimeters and other electrical measuring instruments, their care and correct handling.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install electrical/electronic equipment (continued)</p>	<p>2.16 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.17 explain how to check that components meet the required specification/operating conditions (values, tolerance, current carrying capacity, voltage rating, power rating, working temperature range)</p> <p>2.18 describe the techniques used to terminate electrical equipment (plugs, soldering, screwed, clamped and crimped connections)</p> <p>2.19 explain the use of BS 7671/IEE wiring regulations, and other, regulations when selecting wires and cables and when carrying out tests on systems</p> <p>2.20 describe the methods of attaching markers/labels to components or cables to assist with identification</p> <p>2.21 describe the tools and equipment used in the installation activities (including the use of cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)</p> <p>2.22 explain how to make adjustments to components/assemblies to ensure that they function correctly</p> <p>2.23 explain how to check that tools and equipment are free from damage or defects, and are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.24 explain the importance of making 'off-load' checks before proving the equipment with the electrical supply on</p> <p>2.25 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.26 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.27 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.29 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 7: Installing equipment to produce an engineered system

Unit reference number: M/601/0553

QCF level: 3

Credit value: 123

Guided learning hours: 259

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out the installation of equipment to produce an engineered system, 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 lifting and handling equipment, installation tools, 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 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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Install equipment to produce an engineered system</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use four of the following test instruments during the installation activities:</p> <ul style="list-style-type: none"> - alignment devices (such as plumb lines, spirit levels, inclinometers, laser equipment) - linear measuring devices (such as tapes, dial test indicators, micrometers, verniers, feeler gauges) - electrical measuring equipment (such as multimeter, continuity checker, insulation resistance tester, earth loop impedance tester) - fluid/power testing equipment (such as pressure and flow testing devices, speed measurement devices) - instrumentation test equipment (such as dead weight testers, temperature baths, manometers, pressure gauges) - PLC/PC test equipment (such as logic probes, signal sources, analogue and digital meters) 			
	<p>1.7 install, position and secure the equipment and components in accordance with the specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 carry out the installation of an engineered system, which includes installing and configuring equipment for two of the following interactive technologies (from A, B, C, D or E):</p> <p>A – installing mechanical equipment/components: to include all of the following:</p> <ul style="list-style-type: none"> – installing mechanical equipment (such as machine tools, processing plant, turbines engines transfer equipment) – connecting, levelling, aligning and securing sub-assemblies and units – installing structures (such as guards and fences, safety equipment, overhead supports) – setting and adjusting drive mechanisms (such as shafts and couplings, belt and chain drives) – setting and adjusting operating mechanisms (such as levers, linkages, cams and followers) – setting and adjusting control mechanisms (such as clutches and brakes) <p>B – installing electrical and electronic equipment components: to include all of the following:</p> <ul style="list-style-type: none"> – installing electrical equipment (such as switchgear and distribution panels, motors and starters, luminaires) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - installing wiring enclosures/cable protection systems (such as conduit, trunking and tray work) - installing, routeing and securing wires and cables (such as PVC, mineral and armoured cables) - installing electrical/electronic components (such as relays, sensing devices, limit switches, electronic modules) - installing circuit protectors and safety devices - terminating cables to electrical components and main distribution centre (such as screwed connections, crimped and soldered) - attaching suitable cable identification (such as colour coding, numbering systems or write-on labels). 			
1b Install equipment to produce an engineered system (continued)	<p>C – installing fluid power components: to include all of the following:</p> <ul style="list-style-type: none"> - installing fluid power equipment (such as compressors, pumps, accumulators, storage reservoirs and receivers) - installing rigid and flexible pipework and hoses - installing fluid power components (such as cylinders, valves, sensors, actuators, filters and regulators) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - connecting components to pipework using appropriate fittings - dressing and securing piping and hoses <p>D – installing process controller components: to include all of the following:</p> <ul style="list-style-type: none"> - 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 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>E – installing instrumentation and control components: to include all of the following:</p> <ul style="list-style-type: none"> - installing instrumentation and control equipment (such as pressure, flow, temperature, speed, weight, vibration) - installing and connecting process pipe work - installing and connecting peripherals (such as sensors, actuators, relays, switches) - connecting electrical/pneumatic supply to instruments/sensors - connecting signal transmission components to instruments/sensors - checking and confirming that signal measurement and transmission are satisfactory 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking out positions of all equipment - drilling and preparing holes - moving and positioning equipment, using appropriate lifting and handling equipment - aligning and levelling equipment - shimming and packing - fitting anti-vibration mountings - securing using mechanical fixings (nuts and bolts) - securing using masonry fixings (such as rag or expanding bolts) - securing using adhesives - applying screw fastening locking devices <p>1.10 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 carry out all of the following checks and adjustments, as applicable to the installed system:</p> <ul style="list-style-type: none"> - making visual checks of the installation for completeness and freedom from damage - topping up fluid/oil reservoirs - ensuring that all bolts are correctly torqued and locking devices are fitted to fasteners - ensuring that all electrical connections are correctly made, earth bonding is secure and connections covered - ensuring that all pipe connections are correctly made, secure and leak free - ensuring that all moving parts are guarded and clear of obstruction - checking that the system operates to the installation specification - making sensory checks of the system (sight, sound, smell, touch). 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1c Install equipment to produce an engineered system (continued)</p>	<p>1.12 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.13 use two of the following fault -finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.16 produce installations to comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operation spec/range - BS and/or ISO standards - BS7671/IEE wiring regulations - customer (contractual) standards and requirements - company standards and procedures <p>1.17 complete the relevant paperwork, to include one of the following, and pass to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install equipment to produce an engineered system</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing systems equipment within an engineered system (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing the system equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, BS7671/IEE Regulations, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of drilling holes in masonry for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.11 describe the various mechanical fasteners that will be used, and explain their method of installation</p> <p>2.12 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install equipment to produce an engineered system (continued)</p>	<p>2.13 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.14 describe the methods of levelling and aligning the equipment, and the types of tools, instruments and techniques used for this</p> <p>2.15 explain how to connect to mechanical power transmission devices (such as shafts, couplings belt and chain drives)</p> <p>2.16 describe the different types of cabling used in the installation activities, and explain their method of termination</p> <p>2.17 describe the different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)</p> <p>2.18 describe the installation and termination of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)</p> <p>2.19 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.20 explain how to connect the equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.21 explain the application of ohmmeters, multimeters and other electrical measuring instruments, their care and correct handling</p> <p>2.22 describe the methods of assembling and installing pipework, hoses and fittings</p> <p>2.23 describe the installation and connection of a range of fluid power components (such as pumps, valves, cylinders, actuators, switches and relays)</p> <p>2.24 explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the system</p> <p>2.25 describe the installation of process instrumentation and associated peripherals (such as pressure, flow, temperature devices)</p> <p>2.26 describe the installation of PLC systems and associated peripheral devices (such as I/O devices)</p> <p>2.27 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)</p> <p>2.28 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage)</p> <p>2.29 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.30 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.31 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.32 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p> <p>2.33 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install instrumentation and control equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use two of the following types of test and calibration equipment during the installation activities:</p> <ul style="list-style-type: none"> - 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 <p>1.7 install, position and secure the equipment and components in accordance with the specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install one of the following types of instrumentation and control equipment:</p> <ul style="list-style-type: none"> - pressure monitoring/control - flow monitoring/control - temperature monitoring/control - weight monitoring/control - fiscal (gas/electricity, etc) metering - fire detection and alarm - gas detection and alarm - emergency shutdown - speed measurement - speed control - vibration monitoring/control - nucleonic and radiation - analysers - recorders and indicators - telemetry equipment - control equipment (such as indexing, positioning, sequencing) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 apply installation methods and techniques, to include all of the following, as appropriate to the instruments being installed:</p> <ul style="list-style-type: none"> - positioning and securing equipment/components - making mechanical connections - installing electrical/electronic components - installing and connecting process pipe work - tightening fastenings to the required torque - proof marking/labelling of wires or components - installing and connecting peripherals (such as sensors, actuators, relays, switches, back-up batteries) - taking electrostatic precautions when handling components and circuit boards - setting, calibrating and adjusting instruments - connecting electrical/pneumatic supply to instrument/sensor - connecting signal transmission components to instrument/sensor. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install instrumentation and control equipment (continued)</p>	<p>1.10 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - process supply connections (such as water, gas, oil, chemical, waste) <p>1.11 check that all necessary connections to the equipment are complete</p> <p>1.12 carry out checks and adjustments, appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - testing that the equipment operates to the installation specification plus five more from the following: - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - checking the system for leaks - checking the security of connections/terminations - checking signal transmission (electrical, electronic, pneumatic, mechanical) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - confirming that signal measurement and transmission are satisfactory - carrying out final start-up of the system, and removing any trip defects <p>1.13 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.14 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.15 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.16 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.17 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operation spec/range - BS 7671/IEE wiring regulations - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.18 complete the relevant paperwork, to include one of the following, and pass to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			
<p>2a Know how to install instrumentation and control equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing instrumentation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing instrumentation equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be installed, and explain its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 explain the basic principles of operation of the instrumentation being installed, how the system functions, its operating sequence, the working purpose of individual units/components and how they interact</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.11 explain the reasons for making sure that control systems are isolated or put into manual control, and appropriate trip locks or keys are inserted, before removing any sensors or instruments from the system</p> <p>2.12 explain how to identify and select instrument sensors (including how to identify their markings, calibration information, component values, operating parameters and working range)</p> <p>2.13 describe the methods of checking and calibrating the instruments, and the type and range of equipment that can be used for this</p> <p>2.14 explain the correct way of fitting instruments to avoid faulty readings (caused by head correction, poor flow past sensor, blockages, incorrect wiring, poor insulation or incorrect materials)</p> <p>2.15 explain how to avoid electronic interference or mechanical damage caused by unsuitable positioning of external wiring and components.</p>			
2b Know how to install instrumentation and control equipment (continued)	<p>2.16 explain how to carry out visual checks of the instruments (checking for leaks, security of joints and physical damage)</p> <p>2.17 explain the techniques used to install integrated equipment (build up of pressures/force, connection of pipe/component, dealing with soldered joints, screwed, clamped and crimped connections)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.18 describe the methods of attaching identification marks/labels to components or cables</p> <p>2.19 explain how to connect the equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)</p> <p>2.20 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.21 describe the procedure for the safe disposal of waste materials</p> <p>2.22 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)</p> <p>2.23 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p> <p>2.24 explain 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</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.25 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures</p> <p>2.26 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.27 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.28 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p> <p>2.29 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 9: Installing fluid power equipment

Unit reference number: J/601/0557

QCF level: 3

Credit value: 115

Guided learning hours: 196

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install fluid power equipment, 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 lifting and handling equipment, installation tools, 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 range of fluid power equipment, including hydraulic, pneumatic and vacuum. This will involve the installation of components and units such as pumps, valves, actuators, sensors, intensifiers, regulators, compressors, pipes and hoses, and other specific fluid power equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install fluid power equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use three of the following instruments during the installation activities:</p> <ul style="list-style-type: none"> - pressure testing devices - flow testing devices - mechanical measuring devices - bleeding devices - alignment devices - electrical measuring devices <p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install equipment for one of the following types of fluid power systems:</p> <ul style="list-style-type: none"> - pneumatic - hydraulic - vacuum <p>1.9 carry out installations which include all of the following:</p> <ul style="list-style-type: none"> - rigid pipework - hoses - valves 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>plus twelve more from the following:</p> <ul style="list-style-type: none"> - pumps - compressors - reservoirs/storage - gaskets and seals - lubricators - accumulators - pressure intensifiers - filters - cylinders - switches - receivers - regulators - actuators - sensors - other (specify). 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install fluid power equipment (continued)</p>	<p>1.10 apply installation methods and techniques to include six of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - positioning equipment/components - aligning pipework and connections - dressing and securing pipes and hoses - connecting wires and cables - securing using mechanical fixings - securing using masonry fixings - applying screw fastening locking devices - applying hose/cable clips and fasteners <p>1.11 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - utility service connections <p>1.12 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - ensuring that the equipment operates to the installation specifications <p>plus six more from the following:</p> <ul style="list-style-type: none"> - leak checks - making `off-load` checks - levelling and alignment - system pressure checks - line pressure checks - flow checks - checking the sequencing of the system - checking for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction - ensuring that locking devices are fitted to fasteners (where appropriate) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.15 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.17 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.18 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operation specification/range - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.19 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install fluid power equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing fluid power equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing fluid power equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.11 describe the various mechanical fasteners that will be used and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)</p> <p>2.12 explain the basic principles of operation of the system being installed, and the function of individual modules/components</p> <p>2.13 describe the different types of pipework, fittings and manifolds, and explain their application</p> <p>2.14 explain how to identify the different types of valves (such as poppet, spool, piston, disc) and their application</p> <p>2.15 explain how to identify the different types of sensors and actuators (such as rotary, linear, mechanical, electrical) and their application</p> <p>2.16 explain how to identify the different types of cylinders (such as single acting, double acting) and their application.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install fluid power equipment (continued)</p>	<p>2.17 explain how to identify the different types of pumps (such as positive and non-positive displacement) and their application</p> <p>2.18 explain the application and fitting of static and dynamic seals</p> <p>2.19 explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the system</p> <p>2.20 explain the techniques used during installation of fluid power equipment (release of pressures/force, cylinder/valve movement, sequencing)</p> <p>2.21 explain the procedures for ensuring that they have the correct tools, equipment, and consumables for the installation</p> <p>2.22 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)</p> <p>2.23 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.24 explain how to connect the equipment to service supplies (such as electrical, fluid power, compressed air, oil and any fuel supplies)</p> <p>2.25 describe the procedure for the safe disposal of waste materials</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.26 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)</p> <p>2.27 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p> <p>2.28 explain 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</p> <p>2.29 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.30 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.31 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p> <p>2.32 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 10: Installing process controller equipment

Unit reference number: L/601/0558

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install process controller equipment, 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 lifting and handling equipment, installation tools, 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 range of process controller equipment, that typically includes process controllers or sequential controllers (such as programmable logic controllers (PLCs), or equipment controlled by personal computers (PCs) which are working in an integrated system, involving two or more interactive technologies, such as mechanical, electrical or fluid power. The learner will also install peripheral components and communication links, and will load/download process controller programs, check them for errors, and create back-up copies of completed programs.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install process controller equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris - apply procedures and precautions to eliminate electrostatic discharge hazards 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use three of the following test instruments during the installation activities:</p> <ul style="list-style-type: none"> - multimeter - watt meter - voltmeter - ammeter - insulation resistance tester - earth-loop impedance tester - other specific test equipment <p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install equipment for one of the following types of process controller systems:</p> <ul style="list-style-type: none"> - monitoring system - safety system - diagnostic system - combination system - process/product control system - business management system 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 install one of the following types of process controller equipment/components during installation:</p> <ul style="list-style-type: none"> - fixed input/output (I/O) units - rack mounted controller units - modular controller units <p>plus five more from the following:</p> <ul style="list-style-type: none"> - sensors - actuators - switches - motor starters - modems - printers - PC peripheral devices - panels and sub-assemblies - electrical wires and cables - signal transmission components/cables - overload protection devices - conduit - trunking and tray work 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - fitting inserts (such as rag or expanding bolts) - positioning equipment - connecting wires and cables - securing using mechanical fixings - securing using masonry fixings - levelling and alignment of equipment. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 carry out six of the following cable termination activities:</p> <ul style="list-style-type: none"> - terminating armoured cables - terminating mineral cables - sealing and protecting cable connections - making mechanical/screwed/clamped connections - soldering and de-soldering - attaching suitable cable identification - route and secure wires and cables - heat shrinking (devices and boots) - crimping (tags and pins) - stripping cable insulation/protection - adding cable end fittings <p>1.12 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 carry out all of the following checks on the installation:</p> <ul style="list-style-type: none"> - testing that the equipment operates to the installation specification - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell) - checking the security of connections/terminations - checking signal transmission - confirming that the correct software has been installed - carrying out a final start-up of the system, and removing of any trip defects <p>1.14 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install process controller equipment (continued)</p>	<p>1.15 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.17 check that the installation is complete and that all components are free from damage</p> <p>1.18 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operation spec/range - BS 7671/IEE wiring regulations - BS and/or ISO standards - company standards and procedures - customer (contractual) standards and requirements 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.19 complete relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			
<p>2a Know how to install process controller equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing process control equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the health and safety requirements for the work area where they are carrying out the installation activities (such as when working at heights), and the responsibility these requirements place on them</p> <p>2.4 describe the hazards associated with installing process control equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks of the specifications they are working with</p> <p>2.8 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.9 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.10 describe the various mechanical fasteners that will be used, and explain their method of installation</p> <p>2.11 explain the procedures for ensuring that they have the correct tools, equipment and fasteners for the installation activities</p> <p>2.12 describe the types of tools, instruments and techniques used to position, align, level, secure and adjust the equipment</p> <p>2.13 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.14 explain the basic principles of how the system functions, its operating sequence, the working purpose of individual units/components</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.15 describe the techniques used to connect PLC equipment (plugs, soldering, screwed, clamped and crimped connections)</p> <p>2.16 explain the use of BS7671/IEE wiring, and other, regulations when selecting wires and cables, and when carrying out tests on systems</p>			
<p>2b Know how to install process controller equipment (continued)</p>	<p>2.17 describe the devices and systems for storing programmes</p> <p>2.18 explain the procedures to be applied to storage, location and methods of backing up programmes</p> <p>2.19 describe the different types of interface cards, and explain their application</p> <p>2.20 describe the procedures for the application of computer-based authoring software for design and development</p> <p>2.21 explain the numbering system and codes used for the identification inputs and outputs</p> <p>2.22 explain how to search a programme within the process controller for specific elements</p> <p>2.23 explain how to make adjustments to components to ensure they function correctly</p> <p>2.24 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.25 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)</p> <p>2.26 explain how to recognise installation defects (such as dry connections, communication difficulties, ineffective fasteners, foreign object damage or contamination)</p> <p>2.27 explain 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</p> <p>2.28 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.29 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.30 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.31 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.32 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Install emergency electrical power generation equipment</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 move and position equipment using two of the following:</p> <ul style="list-style-type: none"> - slings - cranes - fork lift - portable lifting devices - block and tackle - rollers/skates - hoists - jacks - manual handling and moving of loads <p>1.7 use three of the following instruments during the installation activities:</p> <ul style="list-style-type: none"> - straight edges and feeler gauges - engineer's levels - dial test indicators - electrical meters - plumb lines and taut wires - alignment telescopes - laser equipment - mechanical measuring devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install, position and secure the equipment and components in accordance with the specification</p> <p>1.9 install one of the following types of emergency power generation equipment:</p> <ul style="list-style-type: none"> - turbine alternator sets - piston engine alternator sets - generators <p>1.10 apply installation methods and techniques to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - fitting inserts (such as rag or expanding bolts) - positioning of equipment - aligning of equipment - levelling of equipment - shimming and packing - fitting anti-vibration mountings. - securing using mechanical fixings - applying screw fastening locking devices. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install emergency electrical power generation equipment (continued)</p>	<p>1.11 make all of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - services supplies (such as water, fuel) <p>1.12 check that all necessary connections to the equipment are complete</p> <p>1.13 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - ensuring that the equipment operates to the installation specification <p>plus six more from the following:</p> <ul style="list-style-type: none"> - checking the operation of all safety devices - checking settings and working clearance - checking consumables (oil, water, fuel) - making 'off-load' checks - checking level and alignment - testing the system for leaks - checking electrical integrity - making visual checks for completeness and freedom from damage 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - checking security of connections (mechanical, electrical, service supplies) - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction - checking the torque setting of fasteners - ensuring that locking devices are fitted to fasteners (where appropriate) - checking the correct operation of the automatic/power failure switching system <p>1.14 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.15 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - emergent problem sequence - injection and sampling - unit substitution <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.17 check that the installation is complete and that all components are free from damage</p> <p>1.18 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating specification/range - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.19 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install emergency electrical power generation equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing emergency power generation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing the equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.9 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.10 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)</p> <p>2.11 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>2.12 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation</p> <p>2.13 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineer's levels, alignment telescopes and laser devices)</p> <p>2.14 describe the techniques used to position, align, level and adjust the equipment</p> <p>2.15 describe the methods of lifting, handling and supporting the equipment during the installation activities</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install emergency electrical power generation equipment (continued)</p>	<p>2.16 describe the methods of connecting to mechanical power transmission devices</p> <p>2.17 explain how to connect the equipment to the service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)</p> <p>2.18 describe the equipment to be installed, and explain its operating procedures and function (to include principles of power generator sets, the function of the stator, rotor and excitation system, principles of AC power generation, electrical losses, synchronizing and loading, output voltage control)</p> <p>2.19 describe the use of generator and prime-mover tripping and protection devices</p> <p>2.20 explain the use of generator and bus terminal connections</p> <p>2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.22 describe the procedure for the safe disposal of waste materials</p> <p>2.23 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)</p> <p>2.24 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.25 explain 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</p> <p>2.26 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.27 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.29 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 12: Installing environmental pollution control equipment

Unit reference number: J/601/0560

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install environmental pollution control equipment, 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 lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install environmental pollution control equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards (such as COMAH, CDM) - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 move and position equipment using two of the following:</p> <ul style="list-style-type: none"> - slings - cranes - fork lift - portable lifting devices - block and tackle - rollers/skates - hoists - jacks - manual handling 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use three of the following instruments during the installation activities:</p> <ul style="list-style-type: none"> - straight edges and feeler gauges - engineer's levels - dial test indicators - mechanical measuring instruments (such as rule, tape) - electrical measuring instruments (such as multimeter) - fluid power measuring equipment (such as pressure, flow) - vibration transducer - plumb lines and taut wires - alignment telescopes - laser equipment - self-diagnosis equipment - theodolite 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install, position and secure the equipment and components in accordance with the specification</p> <p>1.9 install one of the following types of environmental pollution control equipment:</p> <ul style="list-style-type: none"> - 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) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 install six of the following mechanical equipment items:</p> <ul style="list-style-type: none"> - actuators - mechanical drives - burners - containment booms - floor base plates - enclosures - guards - instrumentation - ducting - linkages - pipework and hoses - pumps - gear boxes - couplings - safety devices - seals and gaskets - motors - filters. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install environmental pollution control equipment (continued)	1.1.1 install six of the following electrical equipment items: <ul style="list-style-type: none"> - annunciator - building management device - distribution board - switchgear - control panel or system - safety device - sensor - relay - solenoid - monitoring device - switch - instrumentation - cable and cores - motor and starter 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 apply installation methods and techniques to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - fitting inserts (such as rag or expanding bolts) - positioning of equipment - aligning of equipment - levelling of equipment - shimming and packing - fitting anti-vibration mountings - securing using mechanical fixings - applying screw fastening locking devices <p>1.13 make two of the following connections to external supplies:</p> <ul style="list-style-type: none"> - compressed air - electrical - water - gas <p>1.14 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.15 carry out seven of the following checks, and make corrections/adjustments, as appropriate:</p> <ul style="list-style-type: none"> - ensuring that the equipment meets the requirements of the installation - checking that assembly fits - checking mechanical integrity - checking electrical integrity - making `off-load` checks - making `on-load` checks - checking level and alignment - checking vibration levels - checking temperature levels - making sensory checks (sight, sound, smell, touch) - ensuring dangerous areas are properly guarded - checking torque setting of fasteners - checking for leaks - checking system pressures and flows - checking speeds and feeds - checking lubrication 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.16 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.17 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.18 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.19 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.20 produce installations which comply with one of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards - customer standards and requirements - company standards and procedures <p>1.21 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install environmental pollution control equipment</p>	<p>2.1 explain the specific safety practices and procedures that are to be observed when installing pollution control equipment (including the related legislation, regulations and recommendations, such as the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, Safe Working in Confined Spaces, CE supply of machinery regulations)</p> <p>2.2 explain the pre-installation safety preparations that need to be carried out (such as obtaining permits to work, risk assessments and other safe working practice requirements)</p> <p>2.3 explain the health and safety requirements specific to the particular plant and site installation details</p> <p>2.4 explain risk and hazard assessment (such as associated hazardous substances, their measurements and exposure limits), and how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret installation documentation, drawings, plans, quality control procedures and specifications (including BS and ISO standards, their symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods and techniques for setting out the site for installation of the plant and equipment</p> <p>2.10 describe the methods and techniques used to position, assemble, align and secure the plant and equipment</p> <p>2.11 describe the methods of making holes for floor fixing bolts (including the use of various fittings, grouting and adhesives)</p> <p>2.12 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)</p> <p>2.13 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>2.14 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation</p> <p>2.15 describe the methods of lifting, handling and supporting the equipment.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install environmental pollution control equipment (continued)</p>	<p>2.16 explain how to apply methods and techniques to carry out noise and vibration measurement (including noise and vibration attenuation systems)</p> <p>2.17 explain what checks, tests, corrections and adjustments are required to ensure proper equipment safety, integrity, operation and accuracy</p> <p>2.18 explain how to connect the equipment to external supplies (such as electricity, air, water and gas)</p> <p>2.19 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.20 describe the procedure for the safe disposal of waste materials</p> <p>2.21 explain how to recognise defects (such as leaks, misalignment, component looseness, damage, or contamination)</p> <p>2.22 explain the importance of ensuring that the completed installation is left in a safe, clean and damage-free state</p> <p>2.23 explain the dangers of leaving any exposed potential energy sources, and how these should be made safe</p> <p>2.24 describe typical problems that can occur during the installation, and explain how these can be overcome</p> <p>2.25 explain the importance of using the approved plant change (modification) procedures</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.26 describe the different condition monitoring measurement techniques they need to use</p> <p>2.27 describe the different control systems that are used (such as PLCs)</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.29 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Internal verifier signature: _____ Date: _____
(if sampled)

Unit 13: Installing workplace environmental control equipment

Unit reference number: L/601/0561

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install workplace environmental control equipment, 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 lifting and handling equipment, installation tools, 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 workplace environmental control equipment that will control or monitor a number of different systems, including heating and ventilation, air conditioning and ventilation units, chillers, boilers, lighting, lifts, building/room access, fire systems and CCTV systems, in accordance with approved procedures. The installation will also include sensors, actuators, switches, motor starters, electrical and network cables, thermostats, electronic meters, safety systems/devices, monitoring equipment, inverters, uninterruptible power supplies (UPS), control panels, printed circuit boards, controller units, computer systems, peripheral devices and environmental monitoring and targeting software.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Install workplace environmental control equipment</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use three of the following test instruments/items during the installation activities:</p> <ul style="list-style-type: none"> - 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 <p>1.7 install, position and secure the equipment and components in accordance with the specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install equipment for a workplace environmental control system that monitors/controls three of the following:</p> <ul style="list-style-type: none"> - heating and ventilation - air conditioning and ventilation - lighting - CCTV - chillers - lift control - fire systems - intruder/alarm systems - building/room access - other specific system - boilers 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 install eighteen of the following types of workplace environmental control equipment and components during the installation:</p> <ul style="list-style-type: none"> - sensors - actuators - switches - motor starters - vents/diffusers - electrical cables - network cables - thermostats - electronic meters - heating elements - printers - safety systems - BMS controller units - BMS remote PC - BMS terminal (PC, server) - printed circuit boards - monitoring equipment - annunciation panel - circuit protection devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - electronic control panels - modems - overload protection devices - PC peripheral devices - monitoring/targeting software - inverters - uninterrupt power supplies - batteries - trunking and tray work <p>1.10 apply installation methods and techniques, to include six of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - fitting inserts (such as rag or expanding bolts) - positioning of equipment - levelling of equipment - connecting wires and cables - securing using mechanical fixings - securing using masonry fixings - applying cable clips and ties. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install workplace environmental control equipment (continued)	<p>2.1 carry out six of the following installation activities:</p> <ul style="list-style-type: none"> - terminating mineral or armoured cables - bending and forming conduit - bending and forming trunking and trays - sealing and protecting cable connections - making mechanical/screwed/clamped connections - soldering and de-soldering - attaching suitable cable identification - routing and securing wires and cables - heat shrinking (devices and boots) - crimping (tags and pins) - stripping cable insulation/protection - removing cable end fittings - extracting/inserting components - attaching equipment identification labels/markers 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.2 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - network connections - utility service connections (such as gas, air, water, oil) <p>2.3 check that all necessary connections to the equipment are complete</p> <p>2.4 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - checking that the equipment operates to the installation specification plus five more from the following: - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - checking security of connections/terminations - checking the system for leaks 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - checking signal transmission (electrical, electronic, pneumatic, mechanical) - confirming that signal measurement and transmission are satisfactory - checking and modifying software programmes - carrying out a final start-up of the system and removing any trip defects <p>2.5 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>2.6 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>2.8 check that the installation is complete and that all components are free from damage</p> <p>2.9 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards - company standards and procedures - customer standards and requirements <p>2.10 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install workplace environmental control equipment</p>	<p>3.1 explain the specific safety practices and procedures that they need to observe when installing workplace environmental control equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>3.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>3.3 explain the health and safety requirements for the work area where they are carrying out the installation activities, and the responsibility these requirements place on them</p> <p>3.4 describe the hazards associated with installing workplace environmental control equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>3.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>3.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>3.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>3.8 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>3.9 describe the various mechanical fasteners that will be used, and explain their method of installation</p> <p>3.10 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>3.11 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation</p> <p>3.12 describe the types of tools and instruments used to position, secure and align the equipment</p> <p>3.13 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>3.14 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>3.15 explain the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact</p> <p>3.16 describe the techniques used to assemble electrical equipment (plugs, soldering, screwed, clamped and crimped connections).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to install workplace environmental control equipment (continued)	<p>3.17 explain the use of BS 7671/IEE wiring, and other, regulations for when selecting wires and cables, and when carrying out tests on systems</p> <p>4.1 explain how to make adjustments to components and software programmes to ensure that they function correctly</p> <p>4.2 explain how to connect the equipment to the service supplies (such as electrical, fluid power, compressed air, water and gas)</p> <p>4.3 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>4.4 describe the devices and systems for storing programmes</p> <p>4.5 describe the different types of interface cards, and their application</p> <p>4.6 explain the numbering system and codes used for the identification of inputs and outputs</p> <p>4.7 explain how to search a programme within the process controller for specific elements</p> <p>4.8 explain the programming techniques and codes used (such as interlocking, timers, counters, sub-routines, etc)</p> <p>4.9 explain the techniques involved in editing, entering and removing contacts from lines of logic and, where applicable, the procedure to be followed for 'on' and 'off-line' programming</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>4.10 explain how to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation</p> <p>4.11 explain how to recognise installation defects (such as leaks, poor seals, misalignment, foreign object damage, or contamination)</p> <p>4.12 explain the importance of ensuring that the completed installation is free from dirt and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected</p> <p>4.13 describe the calibration/care and control procedures for the tools and equipment</p> <p>4.14 describe the problems that can occur with the installation operations, and how these can be overcome</p> <p>4.15 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>4.16 explain what recording documentation needs to be completed for the activities undertaken</p> <p>4.17 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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(if sampled)

Unit 14: Installing heating and ventilation equipment

Unit reference number: R/601/0562

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install heating and ventilation equipment, 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 lifting and handling equipment, installation tools, 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 range of heating and ventilation equipment, which will include one of the primary heating sources (gaseous, liquid, solid fuel, electricity and renewable energy). This will also include motors, fans, pumps, valves, couplings, ducting and trunking, heaters, filters, and control devices, such as thermostats and switches.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install heating and ventilation equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 move and position equipment using two of the following:</p> <ul style="list-style-type: none"> - slings - cranes - fork lift - portable lifting devices - block and tackle - rollers/skates - hoists - jacks - manual handling and moving of loads <p>1.7 use five of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - 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 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install, position and secure the equipment and components in accordance with the specification</p> <p>1.9 install equipment for one of the following types of heating and ventilating systems:</p> <ul style="list-style-type: none"> - liquid - gaseous - solid fuel - renewable energy - electrical <p>1.10 carry out installation which includes all of the following:</p> <ul style="list-style-type: none"> - all pipework - hoses - control devices plus twelve more from the following: - boiler - motors - fans - blowers - lubricators - pumps - calorifiers 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - ducting/trunking - gauges/indicators - regulators - sensors and actuators - condenser - valves - safety devices - filters - electrical wiring and connectors - electrical components - gaskets and seals - radiators - other (specify). 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install heating and ventilation equipment (continued)</p>	<p>1.11 apply installation methods and techniques to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - positioning of equipment/components - aligning pipes, connections, ducting and equipment - dressing and securing pipes and hoses - levelling of equipment - connecting wires and cables - fitting anti-vibration mountings - securing by using mechanical fixings - securing by using masonry fixings - applying screw fastening locking devices - applying hose/cable clips and fasteners <p>1.12 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re assembly of transported sub assemblies) - electrical wired connections (excluding simple 'plug in' connections) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - fluid power connections - utility service connections (such as gas, electricity, air, water, oil) <p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - checking that the equipment operates to the installation specification plus six more from the following: - setting working clearance - leak testing - making `off-load` checks - checking level and alignment - pressurising the system - line pressure testing - flow checking - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction - checking torque setting of fasteners 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - ensuring locking devices are fitted to fasteners (where appropriate) - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction - checking torque setting of fasteners - ensuring locking devices are fitted to fasteners (where appropriate) <p>1.15 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.16 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - emergent problem sequence - injection and sampling - unit substitution <p>1.17 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.18 check that the installation is complete and that all components are free from damage</p> <p>1.19 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating specification/range - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.20 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install heating and ventilation equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing mechanical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing mechanical equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to install heating and ventilation equipment (continued)	<p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.11 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)</p> <p>2.12 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>2.13 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.14 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>2.15 describe the methods of lifting, handling and supporting the equipment during the installation activities.</p> <p>2.16 explain the correct operating ranges, including temperature and pressure of secondary heating sources (air and water)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.17 explain the advantages and disadvantages of the application of different local heating systems (such as radiators, in-line duct heaters, skirting heating, fan coil, convectors, storage pipe heaters and air handling units)</p> <p>2.18 explain what the typical building design temperatures are for offices, factories (light and heavy work) warehouses and canteens</p> <p>2.19 explain how to make adjustments to components to ensure they function correctly</p> <p>2.20 explain how to connect the equipment to service supplies (such as electrical, compressed air oil and fuel supplies)</p> <p>2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.22 describe the procedure for the safe disposal of waste materials</p> <p>2.23 how to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)</p> <p>2.24 how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.25 explain 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</p> <p>2.26 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.27 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.29 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 15: Installing air conditioning and ventilation equipment

Unit reference number: D/601/0564

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install air conditioning and ventilation equipment, 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 lifting and handling equipment, installation tools, 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 range of air conditioning and ventilation equipment, which will include air generation, distribution and control systems. This will also include motors, fans, pumps, ducting and trunking, heaters, safety devices, sensors and activators and control devices.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install air conditioning and ventilation equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 move and position equipment using two of the following</p> <ul style="list-style-type: none"> - slings - cranes - fork lift - portable lifting devices - block and tackle - rollers - hoists - jacks - manual handling and moving loads <p>1.7 use three of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - 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 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 install, position and secure the equipment and components in accordance with the specification</p> <p>1.9 install equipment for two of the following types of air conditioning and ventilating systems:</p> <ul style="list-style-type: none"> - remote air conditioning generation - local air conditioning distribution - air conditioning control <p>1.10 carry out installation, which includes all of the following:</p> <ul style="list-style-type: none"> - all pipework - hoses - control devices plus twelve more from the following: - motors - chillers - pumps - humidifiers - regulators - condensers - ducting/trunking - fans - evaporators 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - lubricators - heaters - sensors and actuators - electrical wiring/connectors - electrical components - gaskets and seals - valves - safety devices - gauges/indicators - filters - other (specify). 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install air conditioning and ventilation equipment (continued)</p>	<p>1.11 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - positioning of equipment/components - aligning pipes, connections, ducting and equipment - dressing and securing pipes and hoses - levelling of equipment - connecting wires and cables - fitting anti-vibration mountings - securing by using mechanical fixings - securing by using masonry fixings - applying screw fastening locking devices - apply hose/cable clips and fasteners <p>1.12 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - fluid power connections - utility service connections (such as gas, electricity, air, water, oil) <p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - checking that the equipment operates to the installation specification plus six more from the following: - setting working clearance - leak testing - making `off-load` checks - checking level and alignment - pressurising the system - line pressure testing - flow checking - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - checking the torque setting of fasteners - ensuring locking devices are fitted to fasteners (where appropriate) <p>1.15 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.16 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.17 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.18 check that the installation is complete and that all components are free from damage</p> <p>1.19 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating specification/range - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.20 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			
<p>2a Know how to install air conditioning and ventilation equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing air conditioning equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing air conditioning equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.11 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)</p> <p>2.12 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>2.13 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.14 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>2.15 describe the methods of lifting, handling and supporting the equipment during the installation activities.</p>			
2b Know how to install air conditioning and ventilation equipment (continued)	<p>2.16 explain the correct operating ranges, including temperature and pressure of secondary sources (air and water)</p> <p>2.17 explain the advantages and disadvantages of the application of different local air conditioning systems (such as in line ducts, skirting, fan coil, humidifiers, and air handling units)</p> <p>2.18 explain what the typical building design temperatures are for offices, factories (light and heavy work) warehouses and canteens</p> <p>2.19 explain how to make adjustments to components to ensure that they function correctly</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.20 explain how to connect to the service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)</p> <p>2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.22 describe the procedure for the safe disposal of waste materials</p> <p>2.23 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)</p> <p>2.24 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p> <p>2.25 explain 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</p> <p>2.26 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.27 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.29 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 16: Installing compressed air equipment

Unit reference number: H/601/0565

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install compressed air systems equipment, 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 lifting and handling equipment, installation tools, 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 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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install compressed air equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use three of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - alignment devices - measuring devices (mechanical and electrical) - pressure sensing and monitoring devices - temperature sensing devices - flow testing devices <p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install equipment for two of the following types of compressed air systems:</p> <ul style="list-style-type: none"> - compressed air generation - compressed air distribution - compressed air control <p>1.9 carry out installation which includes all of the following:</p> <ul style="list-style-type: none"> - all pipework - hoses - valves 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>plus twelve more from the following:</p> <ul style="list-style-type: none"> - pumps - driers - motors - compressors - silencers - manifolds - control equipment - sensors and actuators - gauges/indicators - electrical wiring and connectors - electrical components - monitoring equipment - safety devices - filters - regulators - gaskets and seals - lubricators - other (specify) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 apply installation methods and techniques to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - positioning of equipment/components - aligning of pipes, ducting and equipment - dressing and securing pipes and hoses - connecting wires and cables - fitting anti-vibration mountings - securing by using mechanical fixings - securing by using masonry fixings - applying screw fastening locking devices. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install compressed air equipment (continued)	<p>1.11 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - utility service connections (such as gas, electricity, air, water, oil) <p>1.12 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - functionally testing the equipment to ensure that it operates correctly plus four more from the following: <ul style="list-style-type: none"> - setting working clearance - tensioning - topping up fluid/oil reservoirs - making `off-load` checks - checking level and alignment - pressurising the system - line pressure testing - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction - checking the torque setting of fasteners - ensuring locking devices are fitted to fasteners (where appropriate) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.15 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - six point - half-split - input-to-output - function testing - equipment self-diagnostics - emergent problem sequence - injection and sampling - unit substitution <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.17 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.18 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating specification/range - BS and/or ISO standards - customer (contractual) standards and requirements - company standards and procedures <p>1.19 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documents - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install compressed air equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing compressed air equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the health and safety requirements of the work area where they are carrying out the installation activities (especially where working at heights), and the responsibility these requirements place on them</p> <p>2.4 describe the hazards associated with installing compressed air equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)</p> <p>2.11 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)</p> <p>2.12 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved</p> <p>2.13 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation</p> <p>2.14 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineers levels, alignment telescopes and laser devices)</p> <p>2.15 describe the techniques used to position, align, level, adjust and secure the equipment.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install compressed air equipment (continued)</p>	<p>2.16 describe the methods of lifting, handling and supporting the equipment during the installation activities (including chain and rope hoists, pull-lifts/tirfors, rollers and skates, high lifts and the use of levers and crow bars)</p> <p>2.17 explain the working principals of compressed air generation, distribution and associated control systems</p> <p>2.18 explain how to select the correct pipes, hoses and other equipment to accommodate the ranges of pressure</p> <p>2.19 explain how to make adjustments to components to ensure that they function correctly</p> <p>2.20 explain how to connect the equipment to the service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)</p> <p>2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.22 describe the procedure for the safe disposal of waste materials</p> <p>2.23 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)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.24 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p> <p>2.25 explain 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</p> <p>2.26 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.27 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.28 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.29 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install waste/foul water distribution equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use three of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - alignment devices - multimeter - measuring devices - pressure testing devices - flow testing devices <p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install equipment for one of the following types of waste/foul water distribution systems:</p> <ul style="list-style-type: none"> - waste/effluent - storm water - foul water <p>1.9 install and connect two of the following types of pipes:</p> <ul style="list-style-type: none"> - plastic - clay - iron - copper 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 fit eleven of the following components/equipment during the installation:</p> <ul style="list-style-type: none"> - pumps - motors - gates and valves - couplings/connectors - dosing plant - macerators - interceptors - faucets and outlets - manifolds - traps and filters - gauges/indicators - sensors and switches - tanks - control devices - electrical wiring and connectors - ancillary drainage equipment (such as from sinks, toilets, showers) - gaskets and seals. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install waste/foul water distribution equipment (continued)</p>	<p>1.11 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking out of locating and securing positions - drilling and hole preparation - positioning of equipment - connecting equipment to pipework - aligning and securing pipes and flexible hoses - levelling and securing equipment - connecting wires and cables - securing by using mechanical fixings - securing by using masonry fixings - securing by using adhesives (glues or cements) - using the correct lifting and handling equipment <p>1.12 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - utility service connections (such as gas, electricity, air, water, oil) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - functionally testing the equipment to ensure that it operates correctly plus three more from the following: <ul style="list-style-type: none"> - checking level and alignment - flow checking - checking for leaks - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring moving parts are guarded and clear of obstruction <p>1.15 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.16 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - half-split - input-to-output - function testing - unit substitution <p>1.17 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.18 check that the installation is complete and that all components are free from damage</p> <p>1.19 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards - company standards and procedures - customer (contractual) standards and requirements <p>1.20 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to install waste/foul water distribution equipment	<p>2.1 explain 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)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the health and safety requirements for the work area where they are carrying out the installation activities (especially where working at heights), and the responsibility these requirements place on them</p> <p>2.4 describe the hazards associated with installing waste/foul water systems, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 describe the personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives</p> <p>2.11 describe the techniques used to position, align, level, adjust and secure the pipework and equipment</p> <p>2.12 explain the importance of orientation and flow for certain components/equipment</p> <p>2.13 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.14 explain the applications of the different types of pipework systems (such as copper, plastic, lead, iron, clay)</p> <p>2.15 explain the applications of the different types of couplings, and how to make watertight connections between pipes and other components.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install waste/foul water distribution equipment (continued)</p>	<p>2.16 describe the equipment and tools used to bend, form and thread pipework</p> <p>2.17 explain the types of contaminants in water systems, and the problems they can cause</p> <p>2.18 explain what different methods are used to treat water supplies to meet user needs</p> <p>2.19 describe the applications of the different cleaning procedures for pipework and equipment (rod, water jet, solvents)</p> <p>2.20 explain how to make adjustments to components to ensure they function correctly</p> <p>2.21 explain how to connect the equipment to the service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)</p> <p>2.22 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.23 describe the procedure for the safe disposal of waste materials</p> <p>2.24 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p> <p>2.25 explain 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</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.26 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.27 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.29 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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(if sampled)

Unit 18: Installing fresh water distribution equipment

Unit reference number: M/601/0567

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install fresh water distribution systems and equipment, 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 lifting and handling equipment, installation tools, 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 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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install fresh water distribution equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 use three of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - alignment devices - measuring devices - pressure testing devices - flow testing devices - bleeding equipment - multimeter <p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install equipment for one of the following types of fresh water distribution systems:</p> <ul style="list-style-type: none"> - mains cold water - hot water supplies - cold down service - non-mains supplies <p>1.9 install and connect two of the following types of pipes:</p> <ul style="list-style-type: none"> - plastic - clay - iron - copper 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 fit fifteen of the following components/equipment during the installation:</p> <ul style="list-style-type: none"> - pumps - motors - heaters - gates and valves - dosing plant - couplings/connectors - wet and dry risers - cylinders and tanks - gaskets and seals - gauges/indicators - manifolds - filters and traps - sensors and switches - faucets and outlets - control devices - electrical wiring and connectors - ancillary equipment (such as sinks, toilets, showers). 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install fresh water distribution equipment (continued)	<p>1.11 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking-out of locating and securing positions - drilling and hole preparation - positioning of equipment - connecting equipment to pipework - aligning and securing pipes and flexible hoses - levelling and securing equipment - connecting wires and cables - fitting anti-vibration fittings - securing by using mechanical fixings - securing by using masonry fixings - securing by using adhesives (glues or cements) - using the correct lifting and handling equipment <p>1.12 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - utility service connections (such as gas, electricity, air, water, oil) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - functionally testing the equipment to ensure that it operates correctly plus three more from the following: <ul style="list-style-type: none"> - topping up fluid reservoirs - checking level and alignment - pressurising the system - checking for leaks - making visual checks for completeness and freedom from damage - making sensory checks (sight, sound, smell, touch) - ensuring that moving parts are guarded and clear of obstruction <p>1.15 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.16 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - half-split - input-to-output - function testing - unit substitution <p>1.17 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.18 check that the installation is complete and that all components are free from damage</p> <p>1.19 produce installations which comply with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards - company standards and procedures - customer (contractual) standards and requirements <p>1.20 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install fresh water distribution equipment</p>	<p>2.1 explain 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)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the health and safety requirements for the work area where they are carrying out the installation activities (especially where working at heights), and the responsibility these requirements place on them</p> <p>2.4 describe the hazards associated with installing fresh water distribution equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives</p> <p>2.11 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation</p> <p>2.12 describe the techniques used to position, align, level, adjust and secure the equipment, and the types of tools and instruments used</p> <p>2.13 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.14 explain the importance of orientation and flow for certain components/equipment</p> <p>2.15 explain the applications of the different types of couplings, and how to make watertight connections between pipes and other components</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install fresh water distribution equipment (continued)</p>	<p>2.16 describe the equipment and tools used to bend, form and thread pipework</p> <p>2.17 explain the types of contaminants in water systems, and the problems they can cause</p> <p>2.18 the different methods used to treat water supplies to meet user needs</p> <p>2.19 how to make adjustments to components to ensure that they function correctly</p> <p>2.20 explain how to connect the equipment to service supplies (such as electrical, mechanical and fuel supplies)</p> <p>2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.22 describe the procedure for the safe disposal of waste materials</p> <p>2.23 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)</p> <p>2.24 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.25 explain 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</p> <p>2.26 describe the calibration/care and control procedures for the tools and equipment</p> <p>2.27 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.28 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.29 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.30 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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(if sampled)

Unit 19: Installing refrigeration equipment

Unit reference number: A/601/0572

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install refrigeration equipment, 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 lifting and handling equipment, installation tools, 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 range of refrigeration equipment, which will include compression types using air cooled, water cooled condensers, and secondary refrigerants, and air conditioning cooling plants. This will also include motors, compressors, evaporative condensers, evaporators, safety control devices, valves, refrigerant metering devices, sensors, switches, thermostats, meters, thermocouples, timers, interlocks, electrical components and wiring, electronic boards and components, controller units, computer equipment and peripheral devices.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install refrigeration equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the installation:</p> <ul style="list-style-type: none"> - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - provide safe access and working arrangements for the installation area - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids) - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out a site check, prior to the installation, and ensure that all of the following conditions are met:</p> <ul style="list-style-type: none"> - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - any required installation consumables are available - safety and environmental conditions can be met - the installation activities have been planned, prior to beginning the work - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturers' data, settings and other documentation) <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 move and position equipment using the correct methods and techniques, to include two of the following:</p> <ul style="list-style-type: none"> - slings - cranes - fork lift - portable lifting devices - block and tackle - rollers - hoists - jacks - manual handling and moving of loads <p>1.7 use three of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - alignment devices - pressure testing devices - temperature measuring devices - leak testing devices - multimeter - filling and bleeding devices <p>1.8 install, position and secure the equipment and components in accordance with the specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 install equipment for one of the following types of refrigeration equipment:</p> <ul style="list-style-type: none"> - compression types using air cooled condensers - compression types using water cooled condensers - compression types using secondary refrigerants - air conditioning cooling plant <p>1.10 fit eleven of the following components/equipment during the installation:</p> <ul style="list-style-type: none"> - pipework - motors - evaporative condensers - evaporators - compressors - hoses and connectors - vents/diffusers - monitoring equipment - safety devices - sensors and actuators - gaskets and seals - uninterrupted power supplies - interlocks 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - PC peripheral devices - software - electrical wiring and connections - gauges and indicators (such as temperature, humidity, pressure) - electronic modules/components. 			
1b Install refrigeration equipment (continued)	<p>1.11 apply installation methods and techniques, to include five of the following:</p> <ul style="list-style-type: none"> - marking-out of locating and securing positions - drilling and hole preparation - positioning of equipment - aligning and securing pipes, hoses ducting and equipment - levelling of equipment - connecting wires and cables - installing wiring conduit and enclosures - securing by using mechanical fixings - securing by using masonry fixings - applying screw fastening locking devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 make two of the following connections to the installed equipment:</p> <ul style="list-style-type: none"> - mechanical connections (such as re-assembly of transported sub-assemblies) - electrical wired connections (excluding simple 'plug in' connections) - fluid power connections - utility service connections (such as gas, electricity, air, water, oil) <p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 carry out checks and adjustments, as appropriate to the equipment being installed, to include:</p> <ul style="list-style-type: none"> - functionally testing the equipment to ensure that it operates correctly - carrying out pressure leak tests plus five more from the following: - purging equipment of all air (such as dry nitrogen) - using flushing lines and equipment - vapour charging of a system 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - liquid charging of a system - making sensory checks (sight, sound, smell, touch) - making visual checks for completeness and freedom from damage - adding refrigeration lubricants - pumping down a system - setting pressure cut-outs - setting expansion valves - setting thermostats and controls <p>1.15 deal with two of the following conditions during the installation process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.16 use two of the following fault-finding techniques during the checking and testing activities:</p> <ul style="list-style-type: none"> - half-split - function testing - input-to-output - equipment self-diagnostics - unit substitution 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.17 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.18 check that the installation is complete and that all components are free from damage</p> <p>1.19 produce installations which comply with two or more of the following standards:</p> <ul style="list-style-type: none"> - company standards and procedures - equipment manufacturer's operating specification/range - customer (contractual) standards and requirements - BS7671/IEE wiring regulations - BS and/or ISO standards <p>1.20 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install refrigeration equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing refrigeration equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing refrigeration equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the equipment to be installed, its operating procedures and function</p> <p>2.9 describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this</p> <p>2.10 describe the methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives</p> <p>2.11 describe the techniques, tools and instruments used to position, align, level, adjust and secure the equipment</p> <p>2.12 describe the methods of lifting, handling and supporting the equipment during the installation activities</p> <p>2.13 explain the types of compressor, condenser, expansion valves and evaporators, and methods of stopping compressor prime movers</p> <p>2.14 explain the system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures</p> <p>2.15 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</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install refrigeration equipment (continued)</p>	<p>2.16 explain the types and application of primary and secondary refrigerants, and methods of purging and charging the system using liquid and vapour refrigerants</p> <p>2.17 explain the use of vacuum pumps, pressure gauges, compound gauges, flow gauges and indicators</p> <p>2.18 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 their intended purpose</p> <p>2.19 explain how to make adjustments to components to ensure that they function correctly</p> <p>2.20 explain how to connect the equipment to the service supplies (such as electrical, fluid, compressed air, oil and fuel supplies)</p> <p>2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.22 describe the procedure for the safe disposal of waste materials</p> <p>2.23 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)</p> <p>2.24 explain 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</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.25 describe the calibration/care and control procedures for tools and equipment</p> <p>2.26 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.27 describe the fault-finding techniques to be used when the equipment fails to operate correctly</p> <p>2.28 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation</p> <p>2.29 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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(if sampled)

Unit 20: Commissioning mechanical equipment and systems

Unit reference number: F/601/0573

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission mechanical equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities so as to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning on one of the following types of mechanical equipment/systems:</p> <ul style="list-style-type: none"> - machine tools - industrial compressors - conveyors - turbines - elevators - processing plant - lifting and handling equipment - engines - hoppers or large storage vessels (having mechanical systems connected to them) - process control equipment (such as large valves and actuating mechanisms, pumps) - other equipment (specify) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out all of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all fluids, lubricants and grease are at the appropriate level for start-up - all moving parts are clear of obstructions - all labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning methods, techniques and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures, and confirm that the equipment/system meets specifications - run equipment at the recommended initial settings (eg, reduced power/speed/flow) - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - confirm that the final product/process outcomes meet specifications - monitor and record measurements and observations - shut down/isolate the equipment/installation to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission mechanical equipment and systems (continued)	<p>1.9 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - alignment devices - levelling devices - linear measuring instruments - speed measuring devices - multimeter - continuity tester - bleeding equipment - pressure testing devices - flow testing devices - specific diagnostic aids - PLC/PC equipment <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements: either:</p> <ul style="list-style-type: none"> - produce a report of the commissioning activities that includes all of the following: <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <ul style="list-style-type: none"> - rectify the faults as part of the commissioning process, to include carrying out all of the following: <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - commissioning log/report - corrective action report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission mechanical equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning mechanical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out mechanical commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions and other documentation needed in the commissioning process</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks for the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.12 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission mechanical equipment and systems (continued)</p>	<p>2.13 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, adjusting and tensioning belt and chain drives, preloading bearings)</p> <p>2.14 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.15 describe the uses of measuring equipment, such as micrometers, verniers, run-out devices and other measuring devices</p> <p>2.16 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.17 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.18 describe the methods and techniques used to dismantle mechanical equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)</p> <p>2.19 explain how to re-assemble the removed components, and how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.20 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.21 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.22 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.23 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

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(if sampled)

Unit 21: Commissioning electrical/electronic equipment and systems

Unit reference number: J/601/0574

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission electrical/electronic equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities so as to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - ensure all tools and equipment used is within current calibration dates - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning of installations based on two of the following power supply systems:</p> <ul style="list-style-type: none"> - single-phase power circuit - combination power circuits - three-phase power circuit - low voltage (up to 115V) - direct current power circuit <p>1.7 carry out commissioning activities which cover six of the following electrical installations/module/components:</p> <ul style="list-style-type: none"> - switchgear - alarm devices - programmable controllers - power factor correction devices - motors and starters - luminaries - control devices - communication equipment - encoders or resolvers - safety devices - panels or sub-assemblies - emergency/standby batteries 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - overload protection devices - sensors and actuators - electronic modules/units - other electrical equipment (specify) <p>1.8 carry out all the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all circuit protection devices are connected and operative - all wiring/cables are supported/protected (trunking, tray work, conduit, clips and fastenings) - all labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission electrical/ electronic equipment and systems (continued)	<p>1.9 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run equipment at the recommended initial settings (eg, reduced power/speed/flow) - check electrical integrity (such as voltage, current, power rating, resistance values, frequency) - make sensory checks (sight, sound, smell) - run through the operating sequence and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as trip defects speeds, pressures, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - multimeter - watt meter - voltmeter - ammeter - insulation resistance tester - light meter - earth-loop impedance tester - other specific test equipment <p>1.11 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 deal in one of the following ways with installations that do not meet specification requirements: either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running commissioning checks to confirm that correct operation is now achieved <p>1.13 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 check that the configuration is complete and that the equipment operates to specification</p> <p>1.15 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.16 complete all relevant documentation accurately and legibly</p> <p>1.17 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission electrical/electronic equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning electrical/electronic equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out electrical/electronic commissioning activities (such as dangerous voltages, stored charge, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.12 describe the application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)</p> <p>2.13 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission electrical/electronic equipment and systems (continued)</p>	<p>2.14 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as trip speeds, pressure, timing, sequencing)</p> <p>2.15 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.16 describe the uses of measuring equipment, such as multimeters, resistance testers, light meters and other measuring devices</p> <p>2.17 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.18 explain how to conduct any necessary checks to ensure the equipment/circuit integrity, functionality, accuracy and quality</p> <p>2.19 explain how to recognise installation defects (such as voltage drops, damaged insulation, dry connections, ineffective components, foreign object damage, or contamination)</p> <p>2.20 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.21 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, proof marking of components, removal of components by de-soldering)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p> <p>2.23 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.24 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.25 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.26 describe the extent of their own authority, and explain whom they should report to if they have a problem they cannot resolve.</p>			

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(if sampled)

Unit 22: Commissioning engineered systems

Unit reference number: L/601/0575

QCF level: 3

Credit value: 123

Guided learning hours: 259

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Commission engineered systems	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids) - ensure that all tools and equipment used are within current calibration dates - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p> <p>1.6 carry out commissioning of one of the following types of engineered system:</p> <ul style="list-style-type: none"> - automatic equipment (such as robots, CNC machines, automatic welders, paint sprayers) - transfer equipment (such as automated conveyers and elevators, stacking devices) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - product/process checking equipment (such as measuring, metering, monitoring or detection systems) - manufacturing/processing equipment (such as packaging machines, automated product manufacture/ processing equipment) - material handling equipment (such as jigs and fixtures, pick-and-place device - which must include three of the following interactive technologies: <p>A. commissioning mechanical equipment/ components to include confirming all of the following:</p> <ul style="list-style-type: none"> - the position, level and alignment of mechanical units - the correct securing method and torque of fixings - all mechanical connections (such as levers, linkages, shafts and couplings, cams and followers) - the installation of structures (such as guards and fences, safety equipment, overhead supports) - the tensioning/torque setting of drive mechanisms (such as belt and chain drives) - the alignment and operation of control mechanisms (such as clutches and brakes) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>B. commissioning electrical and electronic equipment/components to include confirming all of the following:</p> <ul style="list-style-type: none"> - electrical/electronic equipment is located and secured correctly - inspection of wiring enclosures/cable protection systems for damage/defects (such as conduit, trunking and tray work) - correct operation of electrical/electronic components (such as relays, sensing devices, limit switches, electronic modules) - correct operation of circuit protectors and safety devices - terminations of cables to electrical components and main distribution centre (such as screwed, crimped and soldered connections) <p>C. commissioning fluid power components to include confirming all of the following:</p> <ul style="list-style-type: none"> - fluid power equipment is located and secured correctly - connections of pipework and hoses are properly made - correct electrical and mechanical connections to fluid power components 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission engineered systems (continued)	<ul style="list-style-type: none"> - correct operation of fluid power components - correct operation of sensors and safety devices. <p>D. commissioning process controller components to include confirming all of the following:</p> <ul style="list-style-type: none"> - process controllers or sequential controllers and equipment are located and secured correctly - correct connections of wires and cables to components - correct operation of input/output interfacing - data connection links - programme entries and events (such as counter and timer settings) - correct operation of programme logic controller peripherals (eg, modems, monitors, PC peripheral devices) - signal measurement and transmission are satisfactory <p>E. commissioning instrumentation and control components to include confirming all of the following:</p> <ul style="list-style-type: none"> - instrumentation and control equipment is located and secured correctly - correct connections of process pipe work - correct operation of peripherals (such as sensors, actuators, relays, switches) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - settings and calibration of individual instruments (gauges, sensors, actuators) - correct connections of electrical/pneumatic supply to instruments/sensors - signal transmission supply to instruments/sensors - signal measurement and transmission are satisfactory <p>1.7 carry out all of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all fluids, lubricants and grease are at the appropriate level for start-up - all moving parts are clear of obstructions - all labels, safety and warning signs are attached in the correct locations 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>- all guards, fences and safety systems are in position and operable</p> <p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run the system at reduced power/speed/flow/pressure - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct function - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence) - conduct a trial run of the system at full power/speed/flow/pressure - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1c Commission engineered systems (continued)	<p>1.9 use four of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - alignment devices - measuring devices - electrical measuring equipment - fluid power testing equipment - instrumentation test equipment - PLC/PC test equipment <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.11 deal with installations that do not meet specification requirements in one of the following ways: either: produce a report of the commissioning activities, that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - commissioning log/report - corrective action report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission engineered systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning engineered systems equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out engineered system commissioning activities (such as handling oils, greases, stored pressure/force/charge, dangerous voltages, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions and other documentation needed in the commissioning process</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function, and explain how component systems interact</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.12 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission engineered systems (continued)</p>	<p>2.13 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, adjusting and tensioning belt and chain drives, preloading bearings, levelling and aligning)</p> <p>2.14 explain the methods of connecting to mechanical power transmission devices (such as shafts, couplings belt and chain drives)</p> <p>2.15 describe the commissioning of electrical/electronic equipment/components (such as control, safety and alarm devices)</p> <p>2.16 explain the different types of cabling used in the installation activities, and their methods of termination</p> <p>2.17 explain the different types of wiring enclosures that are used (to include conduit, trunking and tray work systems)</p> <p>2.18 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.19 explain how to connect the equipment to the service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)</p> <p>2.20 describe the commissioning of a range of fluid power components (such as pumps, valves, cylinders/actuators, sensors)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.21 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.22 describe the uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)</p> <p>2.23 describe the calibration/care and control procedures for tools and equipment used during commissioning</p> <p>2.24 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.25 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)</p> <p>2.26 explain how to re-assemble the removed components, and how to adjust them to meet the operating specification</p> <p>2.27 explain how to recognise contaminants, and the effects and likely symptoms of contamination in the system</p> <p>2.28 describe the commissioning of process instrumentation and associated peripheral devices (such as pressure, flow, temperature)</p> <p>2.29 describe the commissioning of PLC systems and associated peripheral devices (such as I/O devices, monitors)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.30 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.31 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.32 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.33 describe the extent of their own authority, and explain whom they should report to when they have a problem they cannot resolve.</p>			

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Internal verifier signature: _____ Date: _____
(if sampled)

Unit 23: Commissioning process controller equipment and systems

Unit reference number: R/601/0576

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out commissioning activities on process controller equipment and systems, in accordance with approved procedures. The learner will be required to commission equipment controlled by a process or sequential controller, such as programmable logic controller (PLC), or personal computer (PC), which is working in an integrated system involving two or more interactive technologies, such as mechanical, electrical or fluid power. This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as printers or remote PCs.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission process controller equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation/programmes used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - ensure that all tools and equipment used are within current calibration dates - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out the commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning on one of the following types of process control installations:</p> <ul style="list-style-type: none"> - monitoring system - safety system - diagnostic system - combination system - process/product control system - business management system <p>which must include one of the following:</p> <ul style="list-style-type: none"> - fixed I/O units - rack-mount controller units - modular controller units <p>plus four of the following types of PLC peripheral equipment:</p> <ul style="list-style-type: none"> - sensors - actuators - switches - motor starters - electrical wire and cable connections - modems - printers - signal transmission components/cables 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - overload protection devices - PC peripheral devices <p>1.7 carry out eight of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - electrostatic precautions are used when handling sensitive components and circuit boards - check for damage to pipework/wiring/equipment following the installation - the equipment has been installed and secured in position according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all input and output devices are connected and operative - communications links are ready for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures, and confirm that the equipment/system meets specifications - run the equipment at reduced power/speed/flow - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Commission process controller equipment and systems (continued)</p>	<p>1.9 during commissioning, carry out seven of the following programming activities:</p> <ul style="list-style-type: none"> - select and use appropriate programming devices (such as terminals, hand-held programmers, PCs) - programme by computer-based authoring (to include subroutines) - use ladder logic, statement lists, or system flowcharts - produce back-ups of completed programs - edit, enter and remove contacts from lines of logic - carry out on-line monitoring of programs - use 'on-' and 'off-line' programming - use single-step mode of operation - load, read and save programs - alter counter and timer settings - force contacts on and off <p>1.10 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - multimeter - watt meter - voltmeter 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - programming devices - ammeter - insulation resistance tester - signal generator - earth-loop impedance tester - monitoring devices - other specific test equipment <p>1.11 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment/programme malfunction - complete malfunction of equipment/programme <p>1.12 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>for equipment being controlled by the process controller, produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>or:</p> <p>for faults in the process controller or associated peripheral equipment, rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks to confirm correct operation is now achieved <p>or:</p> <p>for faults in the process controller programme, rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - rewriting or editing the programme to correct the fault - re-running the commissioning checks and programme to confirm that correct operation is now achieved <p>1.13 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 check that the configuration is complete and that the equipment operates to specification</p> <p>1.15 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.16 complete all relevant documentation accurately and legibly</p> <p>1.17 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission process controller equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning PLC equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out commissioning activities on PLC equipment (such as unexpected programme operation, out of sequence operations), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain the procedures to be applied during the commissioning activity</p> <p>2.9 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.10 explain the procedures for using computer-based authoring software for design and development</p> <p>2.11 explain the numbering system and codes used for identification inputs and outputs</p> <p>2.12 explain the programming techniques and codes used (interlocking, timers, counters, sub-routines, etc)</p> <p>2.13 explain the techniques involved in editing, entering and removing contacts from lines of logic and, where applicable, the procedure to be followed for 'on-' and 'off-line' programming.</p>			
<p>2b Know how to commission process controller equipment and systems (continued)</p>	<p>2.14 explain what checks need to be carried out on the equipment/circuit prior to undertaking the commissioning operations (such as installation damage, I/O function, electrical connections, components are free from moving parts, all guards and safety devices are in place)</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as timing, sequencing)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.17 describe the uses of measuring/test equipment, such as multimeters, signal generators, and other measuring devices or monitoring devices</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, forcing contacts on and off, proofmarking of components, removal of components by de-soldering)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p> <p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problem associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.			

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(if sampled)

Unit 24: Commissioning instrumentation and control equipment and systems

Unit reference number: R/601/0626

QCF level: 3

Credit value: 115

Guided learning hours: 196

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out commissioning activities on instrumentation and control equipment and systems, in accordance with approved procedures. The learner will be required to commission a range of instrumentation and control equipment, such as pressure, flow, and temperature monitoring and control systems, fiscal monitoring equipment (gas/electricity meters, etc), fire and gas detection and alarm systems, industrial weighing systems, speed measurement and control systems, vibration monitoring equipment, nucleonics and radiation measurement, analysers, recorders and indicators, telemetry systems and emergency shutdown systems. This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as small weighing machines, or other hand-held testing equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission instrumentation and control equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation/programmes used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids) - ensure that all tools and equipment used are within current calibration dates - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p> <p>1.6 carry out commissioning on one of the following types of instrumentation and control systems:</p> <ul style="list-style-type: none"> - pressure monitoring/control system - flow monitoring/control system - temperature monitoring/control system 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - weight monitoring/control system - fiscal metering - fire detection and alarm system - gas detection and alarm system - control systems (such as indexing, positioning, sequencing) - emergency shutdown system - speed measurement - speed control system - vibration monitoring/control system - nucleonic and radiation system - analysis systems - telemetry systems 			
	<p>1.7 carry out eight of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all signalling devices are connected and operative - settings, calibration of individual instruments (gauges, sensors, actuators) - all fluid levels, air pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable <p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run the equipment at reduced power/speed/flow/pressure - check for leaks during operations - check that instruments respond as per their operational specifications - monitor and check signal transmission strength 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct function - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as temperature range, pressures, weight limits, flow, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow/pressure - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Commission instrumentation and control equipment and systems (continued)</p>	<p>1.9 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - signal testing devices - standard test gauges - analogue and digital meters - digital pressure indicators - calibrated flow meters - special purpose test equipment - pressure testing devices - comparators - manometers - current injection devices - calibrated weights - logic probes - temperature baths - workshop potentiometers - dead weight testers - insulation testers <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>– complete malfunction of equipment</p> <p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements: either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> – checks and tests undertaken – recommended actions to correct the fault – probable causes/sources of the defect – where the installation fails to meet the specification <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> – identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids – isolating and dismantling the equipment to unit, sub-assembly or component level – replacing damaged or defective items – re-running the commissioning checks, to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission instrumentation and control equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning instrumentation and control equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out instrumentation commissioning activities (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.12 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission instrumentation and control equipment and systems (continued)</p>	<p>2.13 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as temperature, pressure, weight, timing, sequencing)</p> <p>2.14 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.15 describe the uses of measuring equipment (such as signal testing devices, flow or pressure meters and other measuring devices)</p> <p>2.16 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.17 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.18 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/force, proofmarking of components, removal of components by de-soldering)</p> <p>2.19 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p> <p>2.20 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.21 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.22 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.23 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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(if sampled)

Unit 25: Commissioning fluid power equipment and systems

Unit reference number: Y/601/0627

QCF level: 3

Credit value: 115

Guided learning hours: 196

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission fluid power equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation/programmes used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning on one of the following types of fluid power installations:</p> <ul style="list-style-type: none"> - pneumatic - hydraulic - vacuum - combination <p>which must include seven of the following:</p> <ul style="list-style-type: none"> - pumps - compressors - reservoirs/storage - lubricators - valves - accumulators - pressure intensifiers - regulators - cylinders - switches - receivers - actuators - sensors - other specific components 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out eight of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative (mechanical, electrical, PLC) - all fluid power connections have been made correctly - check all ladder logic or sequential tables against actual installation - all sensors are connected and operative - check for contamination, and that fluid levels and line pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run the equipment at reduced pressure/speed/flow - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission fluid power equipment and systems (continued)	<p>1.9 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - alignment devices - pressure testing devices - flow testing devices - measuring devices (mechanical and electrical) - bleeding devices - specific diagnostic aids - PLC/PC equipment <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>produce a report of the commissioning activities, that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-pressurising and bleeding the system (where appropriate) - re-running the commissioning checks, to confirm that correct operation is now achieved 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to commission fluid power equipment and systems	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning fluid power equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out fluid power commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology) and other documents needed in the commissioning process</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain the principles and theories associated with fluid power equipment (including cascading and logic/ladder tables)</p> <p>2.10 explain how to identify different types of fluid power components and their application</p> <p>2.11 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.12 explain the procedures to be applied during the commissioning activity</p> <p>2.13 explain the importance of making 'off-load' checks before running the equipment under power.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission fluid power equipment and systems (continued)</p>	<p>2.14 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as pressure, timing, sequencing)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of instruments (such as pressure, flow testing devices, bleeding devices and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressure/force, proofmarking of components, removal of pipes and connections)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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(if sampled)

Unit 26: Commissioning emergency electrical power generation equipment and systems

Unit reference number: D/601/0628

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out commissioning activities on emergency electrical power generation equipment and systems, in accordance with approved procedures. The learner will be required to commission a range of emergency electrical power generation equipment, such as turbine alternator sets, piston engine sets, and generators.

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission emergency electrical power generation equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p> <p>1.6 carry out commissioning on one of the following types of emergency electrical power generation installations:</p> <ul style="list-style-type: none"> - turbine alternator sets - piston engine alternator sets - generators 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out all of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all sensors are connected and operative - check for contamination, and that fluids, lubricants and grease are at the appropriate levels for start-up - all wiring/cables/pipework are clear of moving parts - all labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specified configurations - run the equipment at recommended initial settings (eg, reduced power) - check for leaks during operations - check to ensure that any exhaust emission meets environmental requirements - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, power output, temperature) - conduct a trial run of the equipment at full power/speed - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Commission emergency electrical power generation equipment and systems (continued)</p>	<p>1.9 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - straight edges and feeler gauges - dial test indicators - electrical measuring devices - strobe - mechanical measuring devices <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements: either: produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks, to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission emergency electrical power generation equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning emergency power generation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out emergency power generation commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.12 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission emergency electrical power generation equipment and systems (continued)</p>	<p>2.13 explain how to make adjustments to components/assemblies to ensure they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings)</p> <p>2.14 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.15 describe the uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)</p> <p>2.16 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.17 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.18 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)</p> <p>2.19 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.20 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.21 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.22 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.23 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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(if sampled)

Unit 27: Commissioning environmental pollution control equipment and systems

Unit reference number: D/601/0631

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission environmental pollution control equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards (such as COMAH, CDM) - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - EC machinery regulations - commissioning procedures - product/process specifications - installation report - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 commission one of the following types of environmental pollution control equipment:</p> <ul style="list-style-type: none"> - air pollution control equipment (such as decarbonisation (CO2 reduction), de-nitrification, deodorising, desulphurisation, dust collectors, smoke filters, scrubbers, and removal of refrigerant gases) - effluent treatment equipment (such as aerobic and anaerobic biochemical treatment, filter screens and presses, liquid separators, waste oil treatment, sewage treatment, industrial waste water treatment) - noise and vibration equipment (such as vibration prevention and isolation, noise attenuation and acoustic enclosures) - waste and used product handling, storing and recycling equipment (eg, appliance recycling, battery recycling, incinerators, ash handling, heat recovery, shredders and crushers, conveyors and sorters, compaction) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 commission six of the following mechanical equipment items:</p> <ul style="list-style-type: none"> - actuators - mechanical drives - burners - guards - instrumentation - linkages - pumps - gear boxes - couplings - safety devices <p>1.8 commission six of the following electrical equipment items:</p> <ul style="list-style-type: none"> - annunciator - building management device - distribution board - switch gear - control panel/system - sensors - monitoring device - instrumentation 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - motor and starter - safety device <p>1.9 carry out all of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to the equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all fluids, lubricants and grease are at the appropriate level for start-up - all moving parts are clear of obstructions - all labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission environmental pollution control equipment and systems (continued)	<p>1.10 use all of the following commissioning methods, techniques and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures, and confirm that the equipment/system meets specifications - run the equipment at recommended initial settings (eg, reduced power/speed/flow) - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - confirm that the final product/process outcomes meet specifications - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 use four of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - alignment devices - PLC/PC test equipment - electrical measuring equipment - mechanical measuring equipment - fluid power testing equipment - instrumentation test equipment <p>1.12 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.13 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>produce a report of the commissioning activities that includes all of the following: checks and tests undertaken</p> <ul style="list-style-type: none"> - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks, to confirm that correct operation is now achieved <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the configuration is complete and that the equipment operates to specification</p> <p>1.16 check that the commissioned equipment complies with one of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.17 complete all relevant documentation accurately and legibly</p> <p>1.18 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - commissioning log/report - corrective action report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission environmental pollution control equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning plant and equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials, such as the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, Safe Working in Confined Spaces, and CE supply of machinery regulations)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out environmental pollution control equipment commissioning activities (such as associated hazardous substances, their measurements and exposure limits), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and job instructions</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain how to apply methods and techniques to carry out noise and vibration measurement (including noise and vibration attenuation systems)</p> <p>2.12 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure</p> <p>2.13 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.14 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission environmental pollution control equipment and systems (continued)</p>	<p>2.15 explain how to make adjustments to components/assemblies to ensure they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the importance of using the approved plant change (modification) procedures</p> <p>2.20 explain the different condition monitoring measurement techniques they need to use</p> <p>2.21 explain the different control systems that are used (such as PLCs)</p> <p>2.22 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.23 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.24 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p> <p>2.25 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.26 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.27 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.28 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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(if sampled)

Unit 28: Commissioning workplace environmental control equipment and systems

Unit reference number: H/601/0632

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission workplace environmental control equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carrying out commissioning of a workplace environmental control system that controls/monitors three of the following:</p> <ul style="list-style-type: none"> - heating and ventilation - air conditioning and ventilation - lighting - CCTV - chillers - lift control - fire systems - intruder/alarm systems - building/room access - boilers - other system (specify) <p>1.7 carry out all the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to equipment following the installation - the equipment has been installed and secured in position according to specification 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - the correct software/programme has been installed - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid power, PLC) - all labels, safety and warning signs are attached in the correct locations - all safety systems are operable <p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - make all necessary adjustments to equipment settings and programmes to achieve specification parameters (such as trip defects, speeds, flow, timing, sequence) - identify and resolve any functional, component or software problems - conduct a trial run of the equipment/system where this is acceptable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - confirm that the system outcomes meet specifications - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			
1b Commission workplace environmental control equipment and systems (continued)	<p>1.9 use three of the following instruments/aids during the commissioning activities:</p> <ul style="list-style-type: none"> - multimeter - watt meter - voltmeter - ammeter - insulation resistance tester - light meter - earth-loop impedance - continuity tester - phase orientation tester - self diagnostic software - other test equipment (specify) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment <p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling equipment to unit, sub-assembly or component level - replacing damaged or defective items 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - re-running the commissioning checks to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - commissioning log/report - corrective action report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission workplace environmental control equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning workplace environmental control systems and equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out workplace environmental control systems commissioning activities (such as misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.10 explain the procedures to be applied during the commissioning activity</p> <p>2.11 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.12 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission workplace environmental control equipment and systems (continued)</p>	<p>2.13 explain how to make adjustments to components/assemblies to ensure that they function correctly</p> <p>2.14 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.15 describe the uses of measuring equipment (such as multimeter, wattmeter, voltmeter, ammeter, insulation resistance tester, light meter, earth-loop impedance tester, continuity tester, phase orientation tester, self-diagnostic software and other measuring devices)</p> <p>2.16 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.17 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.18 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)</p> <p>2.19 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.20 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.21 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.22 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.23 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

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Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(if sampled)

Unit 29: Commissioning heating and ventilation equipment and systems

Unit reference number: J/601/0638

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission heating and ventilation equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning on one of the following types of heating and ventilation installations:</p> <ul style="list-style-type: none"> - liquid - gaseous - solid fuel - renewable energy - electrical <p>which must include ten of the following:</p> <ul style="list-style-type: none"> - pipework - boiler - motors - fans - blowers - pumps - calorifiers - ducting/trunking - gauges/indicators - lubricators - sensors and actuators - condenser - control devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - safety devices - regulators - valves - radiators - electrical components - electrical wiring and connectors - local heating system (such as in-line duct heaters, skirting heating, fan coil, convectors, storage pipe heaters and air handling units) - other (specify) <p>1.7 carry out eight of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/ducting/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid, PLC) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - provisions have been made for emissions to meet environmental requirements - all sensors are connected and operative - check for contamination, and that fluid levels and pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable <p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run the equipment at reduced speed/flow/pressure - check for leaks during operations - check environmental conditions, including emission to atmosphere - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Commission heating and ventilation equipment and systems (continued)</p>	<p>1.9 use four of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - alignment devices - pressure sensing and monitoring flow testing devices - measuring devices (mechanical and electrical) - flushing/bleeding devices - temperature sensing device - specific diagnostic aids - emission testers - PLC/PC equipment <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements: either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission heating and ventilation equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning heating and ventilation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (including the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)</p> <p>2.4 describe the hazards associated with carrying out heating and ventilation commissioning activities (such as stored pressure/fluids, hot surfaces, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 explain what the typical building design temperatures are for offices, factories (light and heavy work), warehouses and canteens</p> <p>2.9 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.10 explain the principles and theories associated with heating and ventilation systems/equipment</p> <p>2.11 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.12 explain the procedures to be applied during the commissioning activity</p> <p>2.13 explain the importance of making 'off-load' checks before running the equipment under power.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to commission heating and ventilation equipment and systems (continued)	<p>2.14 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as pressure, flow, temperature, timing, sequencing)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of measuring equipment (such as pressure, flow testing devices, bleeding devices and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/fluid, proofmarking of components, removal of components by de-soldering)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

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(if sampled)

Unit 30: Commissioning air conditioning and ventilation equipment and systems

Unit reference number: L/601/0642

QCF level: 3

Credit value: 118

Guided learning hours: 224

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out commissioning activities on air conditioning and ventilation equipment and systems, in accordance with approved procedures. The learner will be required to commission a range of air conditioning and ventilation systems, which will include airflow generation, distribution and control systems. This will also include equipment such as motors, fans, pumps, ducting and trunking, heaters, safety devices, sensors and activators, and control devices.

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission air conditioning and ventilation equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p> <p>1.6 carry out commissioning on one of the following types of air conditioning and ventilation installations:</p> <ul style="list-style-type: none"> - remote air conditioning generation - local air conditioning distribution - air conditioning control 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>which must include ten of the following:</p> <ul style="list-style-type: none"> - pipework - motors - chillers - pumps - humidifiers - condensers - ducting/trunking - fans - evaporators - heaters - sensors and actuators - electrical wiring/connectors - control devices - safety devices - gauges/indicators - electrical components - other (specify) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out all of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/ducting/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid, PLC) - provisions have been made for emissions to meet environmental requirements - all sensors are connected and operative - check for contamination, and that fluid levels and pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run the equipment at reduced pressure/speed/flow - check for leaks during operations - check environmental conditions, including emission to atmosphere - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission air conditioning and ventilation equipment and systems (continued)	<p>1.9 use four of the following instruments/devices during the commissioning activities, as appropriate to the equipment:</p> <ul style="list-style-type: none"> - alignment devices - pressure sensing and monitoring - flow testing devices - measuring devices (mechanical and electrical) - flushing and bleeding devices - temperature sensing device - specific diagnostic aids - emission testers - PLC/PC equipment <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements: either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.13 check that the configuration is complete and that the equipment operates to specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission air conditioning and ventilation equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning air conditioning and ventilation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (including the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)</p> <p>2.4 describe the hazards associated with carrying out air conditioning and ventilation commissioning activities (such as stored pressure/fluid, hot/cold surfaces, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what the typical building design temperatures are for offices, factories (light and heavy work), warehouses and canteens</p> <p>2.10 explain the principles and theories associated with air conditioning and ventilation equipment</p> <p>2.11 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.12 explain the procedures to be applied during the commissioning activity</p> <p>2.13 explain the importance of making 'off-load' checks before running the equipment under power</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission air conditioning and ventilation equipment and systems (continued)</p>	<p>2.14 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as emissions, pressure, flow, temperature, timing, sequencing)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of measuring equipment (such as flow testing devices, emission detectors, bleeding devices and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/fluid, proofmarking of components, removal of components by de-soldering)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve</p>			

Learner name: _____ Date: _____

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Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(if sampled)

Unit 31: Commissioning compressed air equipment and systems

Unit reference number: Y/601/0644

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission compressed air equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning on one of the following types of compressed air system installations:</p> <ul style="list-style-type: none"> - compressed air generation - compressed air distribution - compressed air control <p>which must include ten of the following:</p> <ul style="list-style-type: none"> - pumps - driers - motors - compressors - manifolds - gauges/indicators - regulators - silencers - control equipment - sensors and actuators - electrical wiring and connectors - electrical components - lubricators - monitoring equipment - safety devices - other (specify) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out all the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/ducting/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid , PLC) - provisions have been made for emissions to meet environmental requirements - all sensors are connected and operative - check for contamination, and that fluid levels and pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the equipment/system meets specifications - run the equipment at reduced power/speed/flow/pressure - check for leaks during operations - check environmental conditions, including emission to atmosphere - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, emissions) - identify and resolve any functional problems - conduct a trial run on the equipment at full power/speed/flow/pressure - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission compressed air equipment and systems (continued)	<p>1.9 use four of the following instruments/devices during the commissioning activities, as appropriate to the equipment:</p> <ul style="list-style-type: none"> - alignment devices - pressure sensing and monitoring - flow testing devices - measuring devices (mechanical and electrical) - flushing and bleeding devices - temperature sensing device - specific diagnostic aids - emission testers - PLC/PC equipment <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks, to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission compressed air equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning compressed air equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out commissioning activities on compressed air installations (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain the working principals of compressed air generation, distribution and control systems</p> <p>2.10 describe the correct pipes, hoses and other equipment to accommodate different pressure ranges</p> <p>2.11 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.12 explain the procedures to be applied during the commissioning activity</p> <p>2.13 explain the importance of making 'off-load' checks before running the equipment under power.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission compressed air equipment and systems (continued)</p>	<p>2.14 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure they function correctly (such as emissions, pressure, flow)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of measuring equipment (such as pressure, flow testing devices, emission detectors, bleeding devices and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/force, proofmarking of components, removal of components)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

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Internal verifier signature: _____ Date: _____
(if sampled)

Unit 32: Commissioning waste/foul water distribution equipment and systems

Unit reference number: K/601/0650

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission waste/foul water distribution equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p> <p>1.6 carry out commissioning on one of the following types of waste/foul water distribution systems:</p> <ul style="list-style-type: none"> - waste/effluent - storm water - foul water 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>which must include eleven or more of the following waste/foul distribution system equipment:</p> <ul style="list-style-type: none"> - pumps - motors - gates and valves - couplings/connectors - macerators - faucets and outlets - sensors and switches - electrical wiring and connectors - manifolds - traps - tanks - dosing plant - gauges/indicators - control devices - interceptors - pipework (plastic, clay, copper, iron) - ancillary drainage equipment (such as from sinks, toilets, showers) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out all the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/ducting/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid, PLC) - provisions have been made for emissions to meet environmental requirements - all sensors are connected and operative - check for contamination, and that fluid levels and pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures, and confirm that the system/equipment meets specifications - run the equipment at reduced pressure/speed/flow - check for leaks during operations - check environmental conditions, including emission to atmosphere - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission waste/foul water distribution equipment and systems (continued)	1.9 use three of the following instruments/devices during the commissioning activities: <ul style="list-style-type: none"> - alignment devices - multimeter - emission testers - measuring devices - pressure testing devices - PLC/PC - flow testing devices - diagnostic systems 1.10 deal with two of the following conditions during the commissioning process: <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running commissioning checks to confirm correct operation is now achieved 			
	<p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission waste/foul water distribution equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning waste/foul water distribution systems equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (including the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)</p> <p>2.4 describe the hazards associated with carrying out waste/foul water distribution system commissioning activities (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and work instructions</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what types of contaminants can be in water systems, and the problems they can cause</p> <p>2.10 explain the different methods used to treat water supplies to meet user needs</p> <p>2.11 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.12 explain the procedures to be applied during the commissioning activity</p> <p>2.13 explain the importance of making 'off-load' checks before running the equipment under power.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission waste/foul water distribution equipment and systems (continued)</p>	<p>2.14 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting water levels, shut-off conditions)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of measuring equipment (such as alignment devices, pressure and flow testers and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as pressures/force, proofmarking of components, removal of glued/cemented components)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

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Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(if sampled)

Unit 33: Commissioning fresh water distribution equipment and systems

Unit reference number: F/601/0654

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission fresh water distribution equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p> <p>1.6 carry out commissioning on one of the following types of fresh water distribution systems:</p> <ul style="list-style-type: none"> - mains cold water - hot water supplies 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - cold down service - non-mains supplies <p>which must include ten of the following fresh water distribution system equipment:</p> <ul style="list-style-type: none"> - pumps - motors - heaters - traps - couplings/connectors - wet and dry risers - cylinders and tanks - sensors and switches - gauges/indicators - manifolds - dosing plant - gates and valves - faucets and outlets - control devices - electrical wiring and connectors - pipework (clay, plastic, copper, iron) - ancillary drainage equipment (such as from sinks, toilets, showers) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 carry out all the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/ducting/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid, PLC) - provisions have been made for emissions to meet environmental requirements - all sensors are connected and operative - check for contamination, and that fluid levels and pressures are appropriate for start-up - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures, and confirm that the system/equipment meets specifications - run the equipment at reduced pressure/speed/flow - check for leaks during operations - check environmental conditions, including emission to atmosphere - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence) - conduct a trial run of the equipment at full power/speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Commission fresh water distribution equipment and systems (continued)</p>	<p>1.9 use three of the following instruments/devices during the commissioning activities:</p> <ul style="list-style-type: none"> - alignment devices - multimeter - emission testers - measuring devices - pressure testing devices - PLC/PC - flow testing devices - diagnostic systems <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements:</p> <p>either:</p> <p>produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or:</p> <p>rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks, to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check that the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission fresh water distribution equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning fresh water distribution systems and equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (to include the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)</p> <p>2.4 describe the hazards associated with carrying out commissioning activities on fresh water distribution systems (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and work instructions</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain what types of contaminants can be in water systems, and the problems they can cause</p> <p>2.10 explain the different methods used to treat water supplies to meet user needs</p> <p>2.11 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.12 the procedures to be applied during the commissioning activity</p> <p>2.13 the importance of making 'off-load' checks before running the equipment under power.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission fresh water distribution equipment and systems (continued)</p>	<p>2.14 the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks</p> <p>2.15 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting water levels, shut-off conditions)</p> <p>2.16 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.17 describe the uses of measuring equipment (such as alignment devices, pressure and flow testers and other measuring devices)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.19 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.20 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of glued/cemented components)</p> <p>2.21 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.23 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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Unit 34: Commissioning refrigeration equipment and systems

Unit reference number: Y/601/0658

QCF level: 3

Credit value: 114

Guided learning hours: 182

Unit summary

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

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

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Commission refrigeration equipment and systems</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include six of the following:</p> <ul style="list-style-type: none"> - client requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - environmental requirements - installation reports - commissioning procedures - product/process specifications - resources necessary to carry out commissioning (such as manpower, supplies, time constraints) <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out commissioning on one of the following types of refrigeration installations:</p> <ul style="list-style-type: none"> - compression types using air cooled condensers - compression types using water cooled condensers - compression types using secondary refrigerants - air conditioning cooling plant <p>which must contain ten of the following components/equipment:</p> <ul style="list-style-type: none"> - hoses and connectors - monitoring equipment - sensors and actuators - evaporative condensers - electrical wiring and connections - electronic modules/components - compressors - vents/diffusers - motors - pipework - safety devices - evaporators - gaskets and seals 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - uninterrupted power supplies - interlocks - PC peripheral devices - software - gauges and indicators (temperature, humidity, pressure) <p>1.7 carry out all the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the site is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to pipework/wiring/equipment following the installation - the equipment has been installed and secured/torqued in position, according to specification - all utilities are connected and operative - all connections have been made correctly (mechanical, electrical, fluid , PLC) - provisions have been made for emissions to meet environmental requirements - all sensors are connected and operative - check for contamination, and that fluid levels and pressures are appropriate for start-up 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - all wiring/cables/pipework are clear of moving parts - labels, safety and warning signs are attached in the correct locations - all guards, fences and safety systems are in position and operable. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission refrigeration equipment and systems (continued)	<p>1.8 use all of the following commissioning techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the system/equipment meets specifications - run the equipment at reduced speed/flow - check for leaks during operations - check environmental conditions, including emission to atmosphere - make sensory checks (sight, sound, smell, touch) - run through the operating sequence, and check for correct functioning - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence) - conduct a trial run of the equipment at full speed/flow - monitor and record measurements and observations - shut down/isolate equipment/installations to a safe condition 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 use four of the following instruments/devices during the commissioning activities, as appropriate to the equipment:</p> <ul style="list-style-type: none"> - alignment devices - pressure sensing and monitoring - temperature sensing device - leak testing devices - flow testing devices - flushing and bleeding devices - specific diagnostic aids - emission testers - PLC/PC equipment - mechanical measuring devices - electrical measuring instruments <p>1.10 deal with two of the following conditions during the commissioning process:</p> <ul style="list-style-type: none"> - installations with no faults - partial equipment malfunction - complete malfunction of equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal, in one of the following ways, with installations that do not meet specification requirements: either: produce a report of the commissioning activities that includes all of the following:</p> <ul style="list-style-type: none"> - checks and tests undertaken - where the installation fails to meet the specification requirements - probable causes/sources of the defect - recommended actions to correct the fault <p>or: rectify the faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault, using appropriate fault-finding techniques and/or diagnostic aids - isolating and dismantling the equipment to unit, sub-assembly or component level - replacing damaged or defective items - re-running the commissioning checks, to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the configuration is complete and that the equipment operates to specification</p> <p>1.14 check the commissioned equipment complies with two of the following standards:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS7671/IEE wiring regulations - BS and/or ISO standards - health, safety and environmental requirements - customer standards and requirements - company standards and procedures <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - corrective action report - commissioning log/report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission refrigeration equipment and systems</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when commissioning refrigeration equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out refrigeration commissioning activities (such as stored pressure/fluid, hot/cold surfaces, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, BS7671/IEE regulations, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.8 describe the equipment to be commissioned, its operating procedures and function</p> <p>2.9 explain the various types of compressor, condenser, expansion valves and evaporators, and methods of stopping compressor prime movers</p> <p>2.10 explain the system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures</p> <p>2.11 explain the types and application of primary and secondary refrigerants, and methods of purging and charging the system (using liquid and vapour refrigerants)</p> <p>2.12 explain what checks need to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)</p> <p>2.13 explain the procedures to be applied during the commissioning activity.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission refrigeration equipment and systems (continued)</p>	<p>2.14 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.15 explain the importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full-load checks</p> <p>2.16 explain how to make adjustments to components/assemblies to ensure that they function correctly (such as emissions, pressure, flow, temperature, timing, sequencing)</p> <p>2.17 describe the fault diagnostic techniques that can be used to help identify problems with the equipment</p> <p>2.18 explain the uses of measuring equipment (such as pressure, leak testers, flow testing devices, emission detectors, bleeding devices and other measuring devices)</p> <p>2.19 explain the calibration/care and control procedures for the tools and equipment used during commissioning</p> <p>2.20 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning</p> <p>2.21 describe the methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/fluid, proofmarking of components, removal of components by de-soldering)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 explain how to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification</p> <p>2.23 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.24 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.25 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.26 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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Unit 35: Carrying out fault diagnosis on lift installations

Unit reference number: R/601/0660

QCF level: 3

Credit value: 50

Guided learning hours: 60

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out fault diagnosis on lift installations, in accordance with approved procedures. The learner will be required to diagnose faults on a lift involving two or more of the following interactive technologies: mechanical, electrical, fluid power or electronics, both at assembly and sub-assembly/component level. The learner will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, the learner will be expected to identify the fault and its probable cause, and to suggest suitable action to remedy the problem.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Carry out fault diagnosis on lift installations</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the fault diagnostic activities:</p> <ul style="list-style-type: none"> - plan the fault diagnosis to cause minimum disruption to normal working - use the correct issue of company and/or manufacturers' drawings and installation documentation - adhere to risk assessment, COSHH and other relevant safety standards - ensure the safe isolation of the equipment (such as mechanical, electricity, or fluids) - ensure safe access and working arrangements for the installation area - carry out the fault diagnostic activities using approved techniques and procedures - identify the fault and determine appropriate corrective action - dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out fault diagnosis on three of the following aspects of the lift system:</p> <ul style="list-style-type: none"> - mechanical - fluid power - electrical - electronic <p>1.4 review and use all relevant information on the symptoms and problems associated with the products or assets</p> <p>1.5 collect evidence regarding the fault from two of the following sources:</p> <ul style="list-style-type: none"> - monitoring equipment - sensory input (such as sight, sound, smell, touch) - recording devices - operation of the equipment <p>1.6 find faults that have resulted in two of the following:</p> <ul style="list-style-type: none"> - intermittent problem - partial failure/out-of-specification operation - complete malfunction 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 select, use and apply diagnostic techniques, tools and aids to locate faults</p> <p>1.8 use a range of fault diagnostic techniques, to include:</p> <ul style="list-style-type: none"> - half-split technique plus two more from the following: - emergent problem sequence - six-point technique - unit substitution - function testing - injection and sampling - input/output technique. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Carry out fault diagnosis on lift installations (continued)</p>	<p>1.9 use a variety of diagnostic aids and equipment, to include two of the following:</p> <ul style="list-style-type: none"> - manufacturers' manual - algorithms - probability charts/reports - equipment self-diagnostics - circuit diagrams/specifications - logic diagrams - flow charts - fault analysis charts (such as fault trees) - troubleshooting guides <p>1.10 use two of the following types of test equipment to help in the fault diagnosis:</p> <ul style="list-style-type: none"> - mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments) - electrical/electronic measuring instruments (such as multimeters, logic probes, special test instruments) - fluid power test equipment (such as test rigs, flow meters, pressure gauges) <p>1.11 investigate and establish the most likely causes of the faults</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved</p> <p>1.13 determine the implications of the fault for other work and for safety considerations</p> <p>1.14 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault</p> <p>1.15 record details on the extent and location of the faults in an appropriate format</p> <p>1.16 provide a record of the outcome of the fault diagnosis, using one of the following:</p> <ul style="list-style-type: none"> - step-by-step analytical report - corrective action report - company-specific reporting procedure. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to carry out fault diagnosis on lift installations</p>	<p>2.1 explain the health and safety requirements of the area in which they are carrying out the fault diagnosis activities</p> <p>2.2 explain the specific safety precautions to be taken when carrying out the fault diagnosis of lift equipment</p> <p>2.3 describe the isolation and lock-off procedures or permit-to-work procedure that applies</p> <p>2.4 explain the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnosis process; the type of equipment to be used, and where to obtain it</p> <p>2.5 describe the hazards associated with carrying out fault diagnosis on lifts (such as handling oils/greases, stored pressure/force, electrical contact, process controller interface, using faulty or damaged tools and equipment, using practices/procedures that do not follow laid-down procedures), and explain how they can be minimised</p> <p>2.6 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)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain where to obtain, and how to interpret, drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed in the fault diagnosis activities</p> <p>2.8 describe the various fault-finding techniques that can be used, and how they are applied (such as half-split, input/output, emergent problem sequence, six-point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)</p> <p>2.9 explain how to evaluate the various types of information available for fault diagnosis (such as reports, monitoring equipment, sensory inputs, installation records, and operation of the lift).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to carry out fault diagnosis on lift installations (continued)</p>	<p>2.10 explain how to evaluate sensory information (from sight, sound, smell, touch)</p> <p>2.11 explain the procedures to be followed for investigating faults, and how to deal with intermittent conditions</p> <p>2.12 explain how to use the various aids and reports available for fault diagnosis</p> <p>2.13 describe the type of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments, test rigs and pressure and flow devices), how to check it is calibrated or configured correctly for the intended use and that it is free from damage and defects</p> <p>2.14 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems</p> <p>2.15 explain how to relate previous reports/records of similar fault conditions</p> <p>2.16 explain how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on the overall operation</p> <p>2.17 explain how to prepare a report which complies with the company policy on fault diagnosis</p> <p>2.18 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 36: Measuring and setting out lift installations

Unit reference number: M/601/0665

QCF level: 3

Credit value: 23

Guided learning hours: 63

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to measure and set out the lift well and machine room/space for the subsequent installation of lift equipment, in accordance with approved procedures. The learner will be required to measure and set out for new or reconstructed traction or hydraulic lift equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Measure and setting out lift installations</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following activities during the measuring and setting out activity:</p> <ul style="list-style-type: none"> - use the correct general arrangement drawings - use the correct contractual drawings - interpret dimensions accurately - check that tools to be used are within their calibration dates - relay the site instructions to management - reconcile any site difficulties - establish the final positions of the lift shaft and lift motor equipment <p>1.3 obtain and use the correct information for marking-out</p> <p>1.4 obtain the appropriate marking-out equipment and check that it is in a usable condition</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.5 use four of the following when measuring and setting out lift installations: <ul style="list-style-type: none"> - plumb lines - rule/tapes - engineer's level - carpenter's level - engineer's square - laser equipment 			
	1.6 prepare suitable datums and marking out surfaces.			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Measuring and setting out lift installations (continued)	<p>1.7 mark out using appropriate methods</p> <p>1.8 plumb, measure and set out all of the following lift well features:</p> <ul style="list-style-type: none"> - 'plumb' the lift well to establish vertical references - measure and record the lift well dimensions - accurately mark datum lines with plumb lines - ensure safe and adequate running clearances - establish and mark the car guide centre line - establish and mark the positions of lift car guides - mark out the routes of all trunking and conduit within the well - mark out positions of ancillary components (such as buffers, landing frame, switches, push boxes, indicators) - check that the lift can be installed to the design and specification 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 measure and set out the lift machine room/space, to include all of the following:</p> <ul style="list-style-type: none"> - measure the machine room/space dimensions - confirm that equipment can be installed safely - using plumb lines, project and mark the car/counterweight guide centre lines up to the machine room/space - mark the line of the driving sheave and diverting pulley - mark the position of the supporting steels - mark the rope/chain pick up points (where appropriate) - mark the position of the lifting machine, motor generator, floor selector, overspeed governor and controller <p>1.10 check that the marking out complies with the specification to include two of the following:</p> <ul style="list-style-type: none"> - British Standards including BS EN 81 - BS 7255 (code of practice) - customer standards and requirements - company standards and procedures 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 deal promptly and effectively with problems within their control and report those that cannot be resolved</p> <p>1.12 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - job card - company specific documentation. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to measure and setting out lift installations</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when measuring and setting out lift installations (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting the measuring and setting out (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the health and safety requirements of the work area where they are carrying out the measuring and setting out activities, and the responsibility these requirements place on them</p> <p>2.4 describe the hazards associated with measuring and setting out lift installations, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the measuring and setting out activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain the importance of working to the correct specifications when measuring and setting out the lift well and machine room/space</p> <p>2.9 explain what preparations need to be carried out on the lift well and machine room/space prior to the measuring and setting out</p> <p>2.10 describe the lift equipment to be installed, its operating procedures and function</p> <p>2.11 describe the features that have to be marked out in the lift well and machine room/space (including ancillary components).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to measure and setting out lift installations (continued)</p>	<p>2.12 explain the procedures for ensuring that they have the correct equipment for the measuring and setting out activities</p> <p>2.13 describe the types of equipment used to measure and set out the lift well and machine room/space (such as plumb lines, rules/tapes, engineer's and carpenter's levels, engineer's square and laser devices)</p> <p>2.14 describe the methods and techniques used to measure and set out the lift well and machine room/space</p> <p>2.15 explain how to set up and correctly use plumb lines to establish datum lines</p> <p>2.16 explain the importance of taking measurements in three planes (front to back, side to side, and top to bottom) when making sure the lift well will accommodate the lift</p> <p>2.17 describe the points in the lift well where dimensions should be taken (such as at every floor level, and where there are deviations or projections)</p> <p>2.18 describe the calibration/care and control procedures for the tools and equipment used during the measuring and setting activities</p> <p>2.19 describe the problems that can occur with measuring and setting out the lift well and machine room/space, and explain how these can be overcome</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.20 explain what recording documentation needs to be completed for the measuring and setting out activities undertaken</p> <p>2.21 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.22 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Install lift well and ancillary equipment</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the installation activities:</p> <ul style="list-style-type: none"> - plan the installation activities to minimise disruption to normal working - ensure that they have the correct installation documentation (such as drawings, instructions, manufacturers' data, settings and other documentation) - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - ensure that electrical supplies have been isolated - ensure safe access and working arrangements for the installation area - carry out the installation activities using appropriate techniques and procedures - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 confirm that all of the following conditions have been met, prior to installing the lift equipment:</p> <ul style="list-style-type: none"> - the site is suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - the site is accessible, and free from obstructions or hazards - any required installation consumables are available - safety and environmental conditions can be met <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p> <p>1.6 move and position equipment, using two of the following:</p> <ul style="list-style-type: none"> - slings - portable lifting equipment - block and tackle - manual handling 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use two of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - straight edges - engineer's levels - mechanical measuring instruments/devices - electrical measuring instruments - laser equipment - self-diagnosis equipment <p>1.8 install, position and secure the equipment and components in accordance with the specification.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install lift well and ancillary equipment (continued)	<p>1.9 install twelve of the following types of lift well components and ancillary equipment:</p> <ul style="list-style-type: none"> - guide brackets - car frame - safety gear - guide shoes/rollers - filler weights - landing push boxes - indicator panels - buffers - well switches and cams - floor selector devices - decorative finishes - isolation and multiplying pulleys - conduit or trunking - cables and wires - counterweight structure and shoes/rollers - car enclosure panels (such as roof, sides and back) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.10 apply the correct installation methods and techniques for nine of the following:</p> <ul style="list-style-type: none"> - drilling and hole preparation - positioning and securing equipment - aligning of equipment - levelling of equipment - shimming and packing - lifting and supporting - removing protective coatings and burrs - dressing guide joints - connecting electrical wires and cables - securing by using mechanical fixings - securing by using masonry fixings - applying screw fastening locking devices <p>1.11 carry out the necessary checks, and adjust/rectify where appropriate, to include all of the following:</p> <ul style="list-style-type: none"> - working clearance is correct - fluid/oil reservoirs are at an appropriate level - making `off-load` checks - level and alignment are correct - electrical wiring is encased and secureelectrical continuity is achieved 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - visual (for completeness and freedom from damage) - other sensory checks (sound, smell, touch) - moving parts are clear of obstruction and guarded - torque setting of fasteners is correct - locking devices are fitted to fasteners (if appropriate) <p>1.12 check that all necessary connections to the equipment are complete</p> <p>1.13 produce installations which comply with two of the following:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards (including BS EN 81, ISO 9000) - BS 7255 (code of practice) - the Lift Regulations - customer standards and requirements - company standards and procedures <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the installation is complete and that all components are free from damage</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people: <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install lift well and ancillary equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing lift well and ancillary equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing lift well and ancillary equipment, and with the tools and equipment used, and how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain what preparations need to be carried out on the equipment prior to installation</p> <p>2.9 describe the equipment to be installed, its operating procedures and function</p> <p>2.10 describe the various mechanical fasteners that will be used, and explain their method of installation (including threaded fasteners, special securing devices, masonry fixing devices)</p> <p>2.11 explain the importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved</p> <p>2.12 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.13 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches, engineers' levels and laser devices).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install lift well and ancillary equipment (continued)</p>	<p>2.14 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>2.15 describe the methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)</p> <p>2.16 explain the importance of electrical bonding, why it is critical, and why it must be both mechanically and electrically secure</p> <p>2.17 explain what electrical checks must be carried out</p> <p>2.18 describe the procedure for the safe disposal of waste materials</p> <p>2.19 explain how to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the installation</p> <p>2.20 explain how to recognise installation defects (such as leaks, poor seals, misalignment, levels, ineffective fasteners, damage, or contamination)</p> <p>2.21 explain the importance of ensuring that the completed installation is free from dirt, damage and defects</p> <p>2.22 describe the calibration/care and control procedures for the tools and equipment used during the installation activities</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.23 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.24 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.25 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.26 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

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Internal verifier signature: _____ Date: _____
(if sampled)

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install traction lift equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the installation activities:</p> <ul style="list-style-type: none"> - plan the installation activities to minimise disruption to normal working - ensure that they have the correct installation documentation (such as, drawings, instructions, manufacturers' data, settings and other documentation) - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - ensure that electrical supplies have been isolated - ensure safe access and working arrangements for the installation area - carry out the installation activities using appropriate techniques and procedures - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 confirm that all of the following conditions have been met, prior to installing the lift equipment:</p> <ul style="list-style-type: none"> - the site is suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - the site is accessible and free from obstructions or hazards - any required installation consumables are available - safety and environmental conditions can be met <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p> <p>1.6 move and position equipment using two of the following:</p> <ul style="list-style-type: none"> - slings - portable lifting equipment - block and tackle - manual handling and moving of loads 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use two of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - straight edges - engineers' levels - dial test indicators - mechanical measuring instruments/devices - electrical measuring instruments - self-diagnostic equipment <p>1.8 install, position and secure the equipment and components in accordance with the specification.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Install traction lift equipment (continued)</p>	<p>1.9 install all of the following types of traction lift equipment:</p> <ul style="list-style-type: none"> - lifting machine - over-speed governor - diverting pulley - traction sheave - lift controller equipment - lift machine isolation pads - conduit/trunking - cables and wires <p>1.10 apply the correct installation methods and techniques for nine of the following:</p> <ul style="list-style-type: none"> - drilling and hole preparation - positioning and securing the equipment - aligning equipment to plumb lines and marked dimensions - aligning pulley with sheave and counterweight - plumbing with rope pick-up points - aligning governor with rope anchorage and tension frame - levelling the equipment - shimming and packing 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - lifting and supporting - protecting the installation from weather - connecting electrical wires and cables - securing by using mechanical fixings - applying screw fastening locking devices <p>1.11 carry out all necessary checks, and adjust/rectify where appropriate, to include all of the following:</p> <ul style="list-style-type: none"> - working clearance is appropriate - correct application of oils and greases - making `off-load` checks - level and alignment is correct - electrical wiring is encased and secure - electrical continuity is achieved - visual (for completeness and freedom from damage) - other sensory checks (sound, smell, touch) - moving parts are guarded and clear of obstruction - torque setting of fasteners is correct - locking devices are fitted to fasteners (where appropriate) <p>1.12 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 produce installations which comply with two of the following:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards (including BS EN 81) - BS 7255 (code of practice) - customer standards and requirements - company standards and procedures - the Lift Regulations <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the installation is complete and that all components are free from damage</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install traction lift equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing traction lift equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing traction lift equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain what preparations need to be carried out on equipment prior to installation</p> <p>2.9 describe the equipment to be installed, its operating procedures and function</p> <p>2.10 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices)</p> <p>2.11 explain the importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved</p> <p>2.12 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.13 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches, engineers' levels).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install traction lift equipment (continued)</p>	<p>2.14 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>2.15 describe the methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)</p> <p>2.16 explain what electrical checks need to be carried out on the traction lift equipment</p> <p>2.17 explain how to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)</p> <p>2.18 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, damage)</p> <p>2.19 explain the lubrication requirements, and methods for protecting equipment from mechanical and weather damage</p> <p>2.20 explain the importance of ensuring that the completed installation is free from dirt and damage, and that components are correctly covered/protected</p> <p>2.21 describe the calibration/care and control procedures for the tools and equipment used during the installation activities</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.23 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.24 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.25 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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Internal verifier signature: _____ Date: _____
(if sampled)

Unit 39: Installing lift ropes and chains

Unit reference number: J/601/0669

QCF level: 3

Credit value: 25

Guided learning hours: 84

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install lift ropes and chains, in accordance with approved procedures. This will require the learner to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. The learner will be required to install a range of lift ropes and chains, such as suspension ropes and chains, safety ropes and chains, governor ropes and chains. This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install lift ropes and chains	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the installation activities:</p> <ul style="list-style-type: none"> - plan the installation activities to minimise disruption to normal working - ensure that they have the correct installation documentation (such as, drawings, instructions, manufacturers' data, settings and other documentation) - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - ensure that electrical supplies have been isolated - ensure safe access and working arrangements for the installation area - carry out the installation activities, using appropriate techniques and procedures - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 confirm that all of the following conditions have been met, prior to installing the lift ropes and chains:</p> <ul style="list-style-type: none"> - the site is suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - the site is accessible and free from obstructions or hazards - any required installation consumables are available - safety and environmental conditions can be met <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p> <p>1.6 move and position equipment, using two of the following:</p> <ul style="list-style-type: none"> - slings - portable lifting equipment - block and tackle - manual handling and moving of loads <p>1.7 install, position and secure the equipment and components in accordance with the specification.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install lift ropes and chains (continued)	<p>1.9 install all of the following types of lift ropes and chains:</p> <ul style="list-style-type: none"> - suspension ropes - suspension chains - safety ropes - safety chains - governor ropes - governor chains <p>1.10 apply suitable installation methods and techniques, to include all of the following:</p> <ul style="list-style-type: none"> - measuring the position of the car, counterweight or jack crosshead - calculating chain length (including allowances for stretching, overrun/run-by) - calculating rope length (including allowances for stretching, overrun/run-by) - cutting ropes - cutting chains - terminating ropes - terminating chains - positioning and securing ropes - positioning and securing chains - aligning and tensioning ropes 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - aligning and tensioning chains - lifting and supporting - securing using mechanical fixings <p>1.11 carry out all relevant checks, and adjust/rectify where appropriate, to include all the following:</p> <ul style="list-style-type: none"> - working clearance is appropriate - rope tension and length is correct - chain tension and length is correct - correct application of oils and greases - travel limits are set - alignment is correct - visual (for completeness and freedom from damage) - visual (ropes are installed correctly) - visual (chains are installed correctly) - moving parts are guarded and clear of obstruction - torque setting of fasteners is correct (where appropriate) - locking devices are fitted to fasteners (where appropriate) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 check that all necessary connections to the equipment are complete</p> <p>1.13 produce installations which comply with two of the following:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - British Standard BS EN 81 - customer standards and requirements - company standards and procedures <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the installation is complete and that all components are free from damage</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card - rope test certificate. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install lift ropes and chains</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing lift ropes and chains (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing lift ropes and chains, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain the safe use of rope/chain cutting equipment, in accordance with company and statutory legislation</p> <p>2.6 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.7 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain how to carry out currency/issue checks on the specifications they are working with</p> <p>2.9 explain what preparations need to be carried out on the various ropes and chains prior to installation</p> <p>2.10 describe the different ropes and chains to be installed, their construction and operating parameters</p> <p>2.11 describe the different types of rope and chain terminations used</p> <p>2.12 explain how to calculate the correct chain/rope length (including allowances for stretching, overrun/run-by)</p> <p>2.13 describe the measuring equipment used to ensure ropes and chains are the correct length</p> <p>2.14 explain how the length of suspension, safety and governor ropes/chains are calculated from measurements of the relative positions of the lift car counterweight or jack/ram cross head.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install lift ropes and chains (continued)</p>	<p>2.15 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices)</p> <p>2.16 explain the importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved</p> <p>2.17 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.18 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches)</p> <p>2.19 describe the techniques used to position, align, adjust, tension and secure the equipment</p> <p>2.20 describe the methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)</p> <p>2.21 explain how to conduct any necessary checks to ensure the equipment integrity, accuracy and quality of the installation</p> <p>2.22 explain how to recognise installation defects (such as misalignment, ineffective fasteners, damage, broken strands, kinks)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.23 explain the importance of ensuring that the completed installation is free from dirt and damage</p> <p>2.24 describe the calibration/care and control procedures for the tools and equipment used during the installation activities</p> <p>2.25 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.26 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.27 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.28 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(if sampled)

Unit 40: Installing lift doors, frames and ancillary components

Unit reference number: J/601/0672

QCF level: 3

Credit value: 25

Guided learning hours: 84

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install lift doors and frames, and ancillary components, in accordance with approved procedures. This will require the learner to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. The learner will be required to install a range of lift doors, frames and ancillary components, such as power operated doors, manual doors, collapsible gates, bi-parting doors, shutter gates, landing door frame, lift car door frame, landing sill, locks and rollers, door hangers, fire trim and architraves, door operators and safety devices, coupler/skate and door guide shoes. This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Install lift doors, frames and ancillary components</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the installation activities:</p> <ul style="list-style-type: none"> - plan the installation activities to minimise disruption to normal working - ensure that they have the correct installation documentation (such as, drawings, instructions, manufacturers' data, settings and other documentation) - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - ensure that electrical supplies have been isolated - ensure safe access and working arrangements for the installation area - carry out the installation activities, using appropriate techniques and procedures - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 confirm that all of the following conditions have been met, prior to installing the lift equipment:</p> <ul style="list-style-type: none"> - the site is suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - the site is accessible and free from obstructions or hazards - any required installation consumables are available - safety and environmental conditions can be met <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p> <p>1.6 use all of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - straight edges - gap gauges - engineers' levels - mechanical measuring instruments/devices - electrical measuring instruments 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 install, position and secure the equipment and components in accordance with the specification</p> <p>1.8 install all of the following door frames and ancillary components:</p> <ul style="list-style-type: none"> - landing door frame - lift car door frame - landing sill - door guide shoes - door locks and rollers - door hangers - fire trim and architraves - cables and wires - door operators - door safety devices - coupler/skate. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install lift doors, frames and ancillary components (continued)	<p>1.9 install all of the following types of lift door:</p> <ul style="list-style-type: none"> - power operated doors - manual doors - collapsible gates - bi-parting doors - shutter gates <p>1.10 apply installation methods and techniques for seven of the following:</p> <ul style="list-style-type: none"> - drilling and hole preparation - positioning and secure doors and frames - aligning of equipment - levelling of equipment - shimming and packing - lifting and supporting - removing protective coverings - connecting electrical wires and cables - securing by using mechanical fixings - applying screw fastening locking devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 carry out all relevant checks, and adjust/rectify where appropriate, to include all the following:</p> <ul style="list-style-type: none"> - working clearance is suitable - correct application of oils and greases - travel limits are set - making 'off-load' checks - level and alignment is correct - electrical wiring is encased and secure - electrical continuity is achieved - visual (for completeness and freedom from damage) - other sensory checks (sound, smell, touch) - moving parts are guarded and clear of obstruction - torque setting of fasteners is correct - locking devices are fitted to fasteners (where appropriate) <p>1.12 check that all necessary connections to the equipment are complete</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 produce installations which comply with two of the following:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - British Standard BS EN 81 - customer standards and requirements - company standards and procedures <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the installation is complete and that all components are free from damage</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - job card - company specific documentation. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install lift doors, frames and ancillary components</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing lift doors, frames and ancillary components (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing lift doors and frames, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain what preparations need to be carried out on the equipment prior to installation</p> <p>2.9 describe the equipment to be installed, its operating procedures and function</p> <p>2.10 explain the application of the different types of door (including why they have been selected)</p> <p>2.11 explain the different types of door operating systems</p> <p>2.12 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices)</p> <p>2.13 explain the importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved</p> <p>2.14 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install lift doors, frames and ancillary components (continued)</p>	<p>2.15 describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches, engineers levels)</p> <p>2.16 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>2.17 describe the methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)</p> <p>2.18 explain the importance of carrying out electrical checks on lift doors and ancillary components</p> <p>2.19 explain how to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the installation</p> <p>2.20 explain how to recognise installation defects (such as jamming, misalignment, ineffective fasteners, damage)</p> <p>2.21 explain the lubrication requirements, and methods for protecting equipment from damage</p> <p>2.22 explain the importance of ensuring that the completed installation is free from dirt and damage, and of ensuring that any exposed components are correctly covered/protected</p> <p>2.23 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.24 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.25 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.26 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.27 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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(if sampled)

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Check and set lift installations	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the checking activities:</p> <ul style="list-style-type: none"> - use the correct issue of drawings, job instructions and installation specifications - adhere to risk assessment, COSHH and other relevant safety standards - ensure safe access and working arrangements when checking lift installations - check calibration dates of the tools and measuring instruments to be used - carry out the checks on lift installations using the appropriate techniques and procedures - leave the work area in a safe condition - handover the lift installation and documentation to the appropriate people <p>1.3 follow and make appropriate use of the specifications for the product or asset being checked</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.4 check lift installations using all of the following information:</p> <ul style="list-style-type: none"> - customer requirements - equipment specifications - installation data - installation standards <p>1.5 use all the correct tools and inspection equipment and check that they are in usable condition</p> <p>1.6 use two of the following instruments/devices when checking the lift installation:</p> <ul style="list-style-type: none"> - linear measuring devices - multimeter - pressure testing devices - specific diagnostic aids <p>1.7 carry out the checks in an appropriate sequence using approved methods and procedures</p> <p>1.8 carry out installation checks on one of the following types of lift equipment:</p> <ul style="list-style-type: none"> - hydraulic - traction 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.9 carry out all of the following checks prior to initial start-up:</p> <ul style="list-style-type: none"> - the lift is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to lift assemblies following the installation - the lift has been installed and positioned according to specification - all connections have been made correctly (mechanical, electrical, fluid power) - all lubricants and grease have been applied before start-up - all moving parts are clear of obstructions - all fluid levels are correct before start-up - all labels, safety and warning signs are placed in the correct locations - all guarding and safety systems are in position and operable. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Check and set lift installations (continued)</p>	<p>1.10 use all of the following checking techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the lift and associated equipment meets specifications - run the lift equipment at reduced speed - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - check the lift operation/sequence including door opening/closing - identify any functional problems - monitor and record measurements and/or observations - shut down/isolate lift to a safe condition <p>1.11 carry out all the following installation checks, and adjust where appropriate:</p> <ul style="list-style-type: none"> - supply phases and connections to motors - rope terminations - chain terminations - rope tension - chain tension - trailing cables are looped correctly 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - Lubrication points are oiled/greased to specification - gearbox or hydraulic oil levels <p>1.12 carry out all the following checks, and adjust/rectify where appropriate to include:</p> <ul style="list-style-type: none"> - safety circuits - door operators - overrun/run-by - door closing protection devices - lift machine/hydraulic pump unit - lift controller equipment - alarm systems - lift car travel - ancillary equipment - counterweight operates correctly (traction lifts only) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that the lift installation complies with two of the following standards:</p> <ul style="list-style-type: none"> - BS standards and procedures (such as BS EN 81) - customer standards and requirements - company standards and procedures - specific system requirements - the Lift Regulations <p>1.14 Identify and assess any defects or variations from the specification and take appropriate action</p> <p>1.15 rectify faults as part of the checking process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault - dismantling equipment to unit, sub-assembly or component level - proofmarking/labelling components to aid re-assembly - replacing or repairing damaged or defective components - setting, aligning and adjusting replaced components - tightening fastenings to the required torque 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - replenishing oils and greases (where appropriate) - re-running the checks to confirm that correct operation is now achieved <p>1.16 report completion of compliance activities in line with organisational procedures</p> <p>1.17 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - job card - installation report - company specific documentation. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to check and set lift installations</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when checking lift installations (including any specific legislation, regulations or codes of practice for the activities and lift equipment)</p> <p>2.2 explain the procedures to be carried out before checking the lift installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the checking procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out checks on lift installations (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down checking procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing personal protective equipment (PPE) during the checking process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions, and other documents needed in the checking process</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain the principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact</p> <p>2.9 explain what checks need to be carried out prior to starting up the lift (including installation damage, lift obstructions, mechanical and electrical connections, gearbox/hydraulic oil levels, lubrication points, rope and chain terminations and tension)</p> <p>2.10 explain what functional checks need to be carried out at reduced speed (including door operators, overrun/run-by, safety systems, alarm system, lift machine/hydraulic pump, lift controller, counterweight and lift car travel)</p> <p>2.11 explain the equipment operating and control procedures to be applied during the checking activity.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to check and set lift installations (continued)</p>	<p>2.12 explain the importance of making 'off-load' checks before running the equipment under power</p> <p>2.13 explain the importance of running the equipment at reduced speed to ensure satisfactory performance</p> <p>2.14 explain how to make adjustments to lift components/assemblies to ensure that they function correctly</p> <p>2.15 describe the fault diagnostic techniques that can be used to help identify problems with the running of the equipment</p> <p>2.16 describe the measuring equipment used when checking lift installations (such as linear measuring devices, electrical measuring instruments, pressure testing devices and self-diagnostic aids)</p> <p>2.17 explain how to check that tools and equipment are free from damage or defects, are in a safe and usable condition</p> <p>2.18 explain what recording and/or reporting documentation needs to be completed for the activities undertaken</p> <p>2.19 describe the types of problems associated with the checking activity, and explain how they can be overcome</p> <p>2.20 describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.21 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.			

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Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install hydraulic lift equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the installation activities:</p> <ul style="list-style-type: none"> - plan the installation activities to minimise disruption to normal working - ensure that they have the correct installation documentation (such as, drawings, instructions, manufacturers' data, settings and other documentation) - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - ensure that electrical supplies have been isolated - ensure safe access and working arrangements for the installation area - carry out the installation activities, using appropriate techniques and procedures - dispose of waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 confirm that all of the following conditions have been met, prior to installing the hydraulic lift equipment:</p> <ul style="list-style-type: none"> - the site is suitably prepared for the installation to take place - appropriate utilities are available (such as gas, water, air, electricity) - the site is accessible and free from obstructions or hazards - any required installation consumables are available - safety and environmental conditions can be met <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p> <p>1.6 move and position equipment, using two of the following:</p> <ul style="list-style-type: none"> - slings - portable lifting equipment - block and tackle - manual handling and moving of loads 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use two of the following instruments during the installation activities:</p> <ul style="list-style-type: none"> - straight edges - engineers' levels - mechanical measuring instruments/devices - electrical measuring instruments <p>1.8 install, position and secure the equipment and components in accordance with the specification</p> <p>1.9 install both types of hydraulic lifts:</p> <ul style="list-style-type: none"> - direct acting - indirect acting. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install hydraulic lift equipment (continued)	1.10 install all of the following types of hydraulic lift equipment: <ul style="list-style-type: none"> - cylinder base plate - hydraulic cylinder - pump unit - valve block - jack/ram assembly - hydraulic pipes and hoses - over-speed governor - ram head pulley - cylinder, jack/ram brackets and guides - hydraulic controller equipment 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 apply installation methods and techniques to include nine of the following:</p> <ul style="list-style-type: none"> - drilling and hole preparation - positioning and securing equipment to plumbed set-out lines - aligning of equipment - bleeding the fluid power system - topping up fluid/oil reservoirs - levelling of equipment - shimming and packing - lifting and supporting - protecting the installation from weather - connecting electrical wires and cables - securing by using mechanical fixings - securing by using masonry fixings - applying screw fastening locking devices 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 carry out all necessary checks, and adjust/rectify where appropriate, to include all the following:</p> <ul style="list-style-type: none"> - working clearance is appropriate - making 'off-load' checks - level and alignment is correct - fluid/oil reservoirs are at an appropriate level - the system is leak free - electrical wiring is encased and secure - electrical continuity is achieved - rotation of the pump is correct - connections are correctly made (mechanical, hydraulic) - the cylinder and jack/ram extend parallel to the car guide - visual (for completeness and freedom from damage) - other sensory checks (sound, smell, touch) - moving parts are guarded and clear of obstruction - torque setting of fasteners is correct - locking devices are fitted to fasteners (where appropriate) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 check that all necessary connections to the equipment are complete</p> <p>1.14 produce installations which comply with two of the following:</p> <ul style="list-style-type: none"> - equipment manufacturer's operating spec/range - BS and/or ISO standards (including BS EN 81, ISO 9000) - BS7255 (code of practice) - the Lift Regulations - customer standards and requirements - company standards and procedures <p>1.15 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.16 check that the installation is complete and that all components are free from damage</p> <p>1.17 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install hydraulic lift equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing hydraulic lift equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing hydraulic lift equipment, and with the tools and equipment used, and explain how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain what preparations need to be carried out on the equipment prior to installation</p> <p>2.9 describe the equipment to be installed, its operating procedures and function</p> <p>2.10 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)</p> <p>2.11 explain the importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved</p> <p>2.12 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities</p> <p>2.13 describe the tools and instruments used to position, secure and align the equipment (such as spanners, crow bars, torque wrenches, engineers' levels).</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to install hydraulic lift equipment (continued)</p>	<p>2.14 describe the techniques used to position, align, level, adjust and secure the equipment</p> <p>2.15 explain the techniques used during installation of hydraulic equipment (release of pressures/force, cylinder/valve movement, sequencing)</p> <p>2.16 describe the methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)</p> <p>2.17 explain the importance of carrying out the appropriate electrical checks on hydraulic lift equipment</p> <p>2.18 explain how to conduct any necessary checks and adjustments to ensure the equipment integrity accuracy and quality of the installation (including the fitting of guards and covers on electrical connections)</p> <p>2.19 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, damage)</p> <p>2.20 explain the lubrication requirements, and methods for protecting equipment from mechanical and weather damage</p> <p>2.21 explain the importance of ensuring that the completed installation is free from dirt and damage, and of ensuring that any exposed components are correctly covered/protected</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.22 describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures</p> <p>2.23 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.24 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.25 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.26 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

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Unit 43: Carrying out fault diagnosis on escalator installations

Unit reference number: H/601/0677

QCF level: 3

Credit value: 50

Guided learning hours: 60

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out fault diagnosis on escalator installations, in accordance with approved procedures. The learner will be required to diagnose faults on an escalator involving two or more of the following interactive technologies: mechanical, electrical, or electronics, at both assembly and sub-assembly/component level. The learner will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, the learner will be expected to identify the fault and its probable cause, and to suggest appropriate action to remedy the problem. The equipment to be diagnosed could be either an escalator or passenger conveyor equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1a Carry out fault diagnosis on escalator installations</p>	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the fault diagnostic activities:</p> <ul style="list-style-type: none"> - plan the fault diagnosis to cause minimal disruption to normal working - use the correct issue of company and/or manufacturers' drawings and maintenance documentation - adhere to risk assessment, COSHH and other relevant safety standards - ensure the safe isolation of equipment (such as mechanical or electricity) - provide safe access and working arrangements for the maintenance area - carry out the fault diagnostic activities using approved techniques and procedures - identify the fault and determine the appropriate corrective action - dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 carry out fault diagnosis on two of the following types of escalator equipment:</p> <ul style="list-style-type: none"> - mechanical - electrical - electronic <p>1.4 review and use all relevant information on the symptoms and problems associated with the products or assets</p> <p>1.5 collect evidence regarding the fault from two of the following sources:</p> <ul style="list-style-type: none"> - monitoring equipment - recording devices - sensory input (such as sight, sound, smell, touch) - operation of the equipment <p>1.6 find faults that have resulted in two of the following conditions:</p> <ul style="list-style-type: none"> - intermittent problem - partial failure/out-of-specification operation - complete malfunction 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 select, use and apply diagnostic techniques, tools and aids to locate faults</p> <p>1.8 use a range of fault diagnostic techniques to include:</p> <ul style="list-style-type: none"> - half-split technique <p>plus one more from the following:</p> <ul style="list-style-type: none"> - emergent problem sequence - six-point technique - unit substitution - function testing - injection and sampling - input/output technique. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>1b Carry out fault diagnosis on escalator installations (continued)</p>	<p>1.9 use a variety of diagnostic aids and equipment to include two of the following:</p> <ul style="list-style-type: none"> - manufacturer's manual - algorithms - probability charts/reports - equipment self-diagnostics - circuit diagrams/specifications - logic diagrams - flow charts - fault analysis charts (such as fault trees) - troubleshooting guides <p>1.10 use all of the following types of test equipment to help in the fault diagnosis:</p> <ul style="list-style-type: none"> - mechanical measuring equipment (such as dial test indicators, torque instruments) - electrical/electronic measuring instruments (such as multimeters, logic probes, special test equipment) <p>1.11 investigate and establish the most likely causes of the faults</p> <p>1.12 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.13 determine the implications of the fault for other work and for safety considerations</p> <p>1.14 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault</p> <p>1.15 record details on the extent and location of the faults in an appropriate format</p> <p>1.16 provide a record of the outcome of the fault diagnosis using one of the following:</p> <ul style="list-style-type: none"> - installation records - job card - company specific documentation. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to carry out fault diagnosis on escalator installations</p>	<p>2.1 explain the health and safety requirements of the area in which they are carrying out the fault diagnosis activities</p> <p>2.2 explain the specific safety precautions to be taken when carrying out the fault diagnosis of escalator equipment</p> <p>2.3 describe the isolation and lock-off procedure or permit-to-work procedure that applies</p> <p>2.4 explain the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnosis process; the type of equipment to be used, and where to obtain it</p> <p>2.5 describe the hazards associated with carrying out fault diagnosis on escalators (such as handling oils/greases, electrical contact, process controller interface, using faulty or damaged tools and equipment, using practices that do not follow laid-down procedures), and explain how they can be minimised</p> <p>2.6 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)</p> <p>2.7 explain where to obtain, and how to interpret, drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed in the fault diagnosis process</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 describe the various fault-finding techniques that can be used, and how they are applied (such as half-split, input/out put, emergent problem sequence, six-point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)</p> <p>2.9 explain how to evaluate the various types of information available for fault diagnosis (such as monitoring equipment, sensory input, and operation of the escalator)</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to carry out fault diagnosis on escalator installations (continued)</p>	<p>2.10 explain how to evaluate sensory conditions by sight, sound, smell, touch</p> <p>2.11 explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions</p> <p>2.12 explain how to use the various aids and reports available for fault diagnosis</p> <p>2.13 describe the type of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments), and how to check it is calibrated or configured correctly for the intended use, and that it is free from damage and defects</p> <p>2.14 explain the application of specific fault-finding methods and techniques best suited to the problem</p> <p>2.15 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems</p> <p>2.16 explain how to evaluate the likely risk of running the equipment with the fault, and the effects the fault could have on the overall operation</p> <p>2.17 explain how to prepare a report which complies with the company policy on fault diagnosis</p> <p>2.18 describe the extent of their own responsibility, and explain whom they should report to if they have problems that they cannot resolve.</p>			

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Unit 44: Installing escalator equipment

Unit reference number: H/601/0680

QCF level: 3

Credit value: 33

Guided learning hours: 161

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to install escalator equipment, in accordance with approved procedures. This will require the learner to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. The learner will be required to install a range of escalator components and sub-assemblies, such as gearbox, motor, brake equipment, guide system, chains, steps, step rollers, balustrades, handrails, skirting, safety devices, control equipment, panelling and décor, and cables and wires. This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Install escalator equipment	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the installation activities:</p> <ul style="list-style-type: none"> - plan the installation activities to minimise disruption to normal working - ensure that correct installation documentation is used (eg, drawings, instructions and other documentation) - adhere to risk assessment, COSHH and other relevant safety standards - obtain clearance to carry out the installation activities - ensure that electrical supplies have been isolated - ensure safe access and working arrangements for the installation area - carry out the installation activities using appropriate techniques and procedures - work to approved method statements and safe systems of work - dispose of waste items in a safe and environmentally acceptable manner 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>- leave the work area in a safe condition and free from foreign object debris</p> <p>1.3 confirm that all of the following conditions have been met, prior to installing the escalator equipment:</p> <ul style="list-style-type: none"> - the site is suitably prepared for the installation to take place - the appropriate electrical supply is available - the site is accessible and free from obstructions or hazards - any required installation consumables are available - safety and environmental conditions can be met <p>1.4 follow all relevant drawings and specifications for the installation being carried out</p> <p>1.5 use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition</p> <p>1.6 move and position equipment using two of the following:</p> <ul style="list-style-type: none"> - slings - portable lifting equipment - block and tackle - manual handling and moving of loads 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use two of the following instruments/devices during the installation activities:</p> <ul style="list-style-type: none"> - straight edges - engineers' levels - mechanical measuring instruments/devices - electrical measuring instruments - self-diagnostic equipment <p>1.8 install, position and secure the equipment and components in accordance with the specification.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Install escalator equipment (continued)	<p>1.9 install all of the following escalator components or sub-assemblies:</p> <ul style="list-style-type: none"> - gearbox - motor - brake equipment - guide system - chains - steps - step rollers - balustrade - handrails - skirting - safety devices - electrical control equipment - panelling and décor - cables and wires <p>1.10 apply appropriate installation methods and techniques, to include nine of the following:</p> <ul style="list-style-type: none"> - drilling and hole preparation - positioning and securing equipment - aligning of equipment - assembling components 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<ul style="list-style-type: none"> - shimming and packing - lifting and supporting - protecting the installation from the environment - connecting electrical wires and cables - securing by using mechanical fixings - applying screw fastening locking devices <p>1.11 carry out all relevant checks, and adjust/rectify where appropriate, to include all the following:</p> <ul style="list-style-type: none"> - working clearance is appropriate - correct application of oils and greases - level and alignment is correct - electrical wiring is terminated correctly - electrical wiring is encased and secure - visual (for completeness and freedom from damage) - other sensory checks (sound, smell, touch) - moving parts are guarded and clear of obstruction - torque setting of fasteners is correct - locking devices are fitted to fasteners (where appropriate) 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.12 check that all necessary connections to the equipment are complete</p> <p>1.13 produce installations which comply with two of the following :</p> <ul style="list-style-type: none"> - equipment manufacturer's operation range - British Standard BS 7801 (code of practice) - customer standards and requirements - company standards and procedures <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.15 check that the installation is complete and that all components are free from damage</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - installation records - company specific documentation - job card. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to install escalator equipment</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when installing escalator equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)</p> <p>2.2 explain the procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain 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</p> <p>2.4 describe the hazards associated with installing escalator equipment, and with the tools and equipment used, and how they can be minimised</p> <p>2.5 explain what personal protective equipment (PPE) they need to use for the installation activities, and where it can be obtained</p> <p>2.6 explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation, (including BS and ISO schematics, symbols and terminology)</p> <p>2.7 explain how to carry out currency/issue checks on the specifications they are working with</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.8 explain the importance of working to the correct specifications when installing escalator equipment</p> <p>2.9 explain what preparations need to be carried out on equipment prior to installation</p> <p>2.10 describe the equipment to be installed, its operating procedures and function</p> <p>2.11 describe the various mechanical fasteners that will be used, and explain their method of installation (including, threaded fasteners, special securing devices)</p> <p>2.12 explain the importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved</p> <p>2.13 explain the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to install escalator equipment (continued)	<p>2.14 describe the tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches)</p> <p>2.15 describe the techniques used to position, align, adjust and secure the equipment</p> <p>2.16 describe the methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)</p> <p>2.17 explain what electrical checks need to be carried out on escalator equipment</p> <p>2.18 explain how to conduct any necessary checks and adjustments to ensure the equipment integrity, function, accuracy and quality of the installation</p> <p>2.19 explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, damage)</p> <p>2.20 explain the lubrication requirements, and methods for protecting equipment from mechanical and environmental damage</p> <p>2.21 explain the importance of ensuring that the completed installation is free from dirt and damage, and that electrical components are correctly covered/protected</p> <p>2.22 describe the calibration/care and control procedures for the tools and equipment used during the installation activities</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.23 describe the problems that can occur with the installation operations, and explain how these can be overcome</p> <p>2.24 explain what recording documentation needs to be completed for the activities undertaken</p> <p>2.25 describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials</p> <p>2.26 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.</p>			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(if sampled)

Unit 45: Commissioning escalator installations

Unit reference number: A/601/0684

QCF level: 3

Credit value: 100

Guided learning hours: 182

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out commissioning activities on escalator installations, in accordance with approved procedures. The learner will be expected to check that the escalator has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, including resolving problems and rectifying faults at component or sub-assembly level, in accordance with company policy and manufacturers' instructions.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Sema Assessment Strategy'. Detailed information is in *Annexe E*.

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Commission escalator installations	<p>1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines</p> <p>1.2 carry out all of the following during the commissioning activities:</p> <ul style="list-style-type: none"> - plan the commissioning activities to minimise disruption to normal working - ensure the currency of all documentation used in the commissioning activities - adhere to risk assessment, COSHH and other relevant safety standards - ensure that all tools and equipment used are within current calibration dates - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids) - obtain clearance to carry out the commissioning activities - provide safe access and working arrangements for the commissioning area - dispose of any waste items in a safe and environmentally acceptable manner - leave the work area in a safe condition and free from foreign object debris 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.3 follow all relevant setting up and operating specifications for the products or assets being configured</p> <p>1.4 gather all the information required to undertake the commissioning, to include five of the following:</p> <ul style="list-style-type: none"> - customer requirements - equipment specifications - manufacturers' manuals/settings - regulations and guidelines - installation data - installation standards - commissioning procedures <p>1.5 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.6 carry out all the following checks prior to initial start-up of the escalator:</p> <ul style="list-style-type: none"> - the escalator is free from obstructions/hazards, and safety/environmental conditions have been met - check for damage to escalator assemblies following the installation - the escalator has been installed and positioned according to specification - all connections have been made correctly (mechanical, electrical) - all lubricants and grease have been applied before start-up - all moving parts are clear of obstructions - all fluid levels are correct before start-up - safety and warning signs are placed in the correct locations - all barriers and safety systems are in position and operable - working clearances between combs, steps and skirtings are correct - machinery access covers are fitted correctly 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.7 use all of the following checking techniques, methods and procedures:</p> <ul style="list-style-type: none"> - carry out start-up procedures and confirm that the escalator equipment meets specifications - run the equipment at operating speed - check for leaks during operations - make sensory checks (sight, sound, smell, touch) - run through the escalator operating sequence and check for correct functioning - identify any functional problems - shut down the escalator to a safe condition <p>1.8 use two of the following instruments/devices when checking the escalator installation:</p> <ul style="list-style-type: none"> - linear measuring devices - multimeter - specific diagnostic aids. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Commission escalator installations (continued)	<p>1.9 make final adjustments to all of the following:</p> <ul style="list-style-type: none"> - handrail tension - chain assemblies - skirting clearances - safety devices - guiding systems - gearbox backlash <p>1.10 carry out functional checks and, where appropriate, adjust all of the following to meet the specification:</p> <ul style="list-style-type: none"> - stopping distances - emergency and auxiliary brakes - handrails run synchronously with step-band - escalator running direction is in line with the key position switch - safety devices operate correctly and in the correct sequence - auxiliary equipment (such as fire alarms, fire shutters and power management systems) are connected and operate correctly - electrical continuity is confirmed 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.11 rectify faults as part of the commissioning process, to include carrying out all of the following:</p> <ul style="list-style-type: none"> - identifying the source of the fault - dismantling the equipment to unit, sub-assembly or component level - proofmarking/labelling components to aid re-assembly - replacing or repairing damaged or defective components - setting, aligning and adjusting replaced components - tightening fastenings to the required torque - replenishing oils and greases (where appropriate) - re-running the commissioning checks to confirm that correct operation is now achieved <p>1.12 deal promptly and effectively with problems within their control and report those that cannot be solved</p> <p>1.13 check that the configuration is complete and that the equipment operates to specification</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>1.14 check that the escalator installation complies with two of the following quality and accuracy standards:</p> <ul style="list-style-type: none"> - British Standard BSEN 115 - customer standards and requirements - company standards and procedures - specific system requirements <p>1.15 complete all relevant documentation accurately and legibly</p> <p>1.16 complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> - commissioning log/report - corrective action report - job sheet - customer specific documentation - handover report. 			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2a Know how to commission escalator installations</p>	<p>2.1 explain the specific safety practices and procedures that they need to observe when checking escalator installations (including any specific legislation, regulations or codes of practice for the activities)</p> <p>2.2 explain the procedures to be carried out before checking the escalator installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)</p> <p>2.3 explain the specific health and safety precautions to be applied during the commissioning procedure, and their effects on others</p> <p>2.4 describe the hazards associated with carrying out checks on escalator installations (handling oils, greases, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down checking procedures), and explain how to minimise them</p> <p>2.5 explain the importance of wearing appropriate personal protective equipment (PPE) during the commissioning process, and where it can be obtained</p> <p>2.6 explain how to obtain and interpret drawings, specifications, manufacturers' manuals, instructions, and other documents needed in the commissioning process</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	<p>2.7 explain the principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact</p> <p>2.8 explain what checks need to be carried out prior to starting up the escalator (including installation damage, escalator obstructions, mechanical and electrical connections, working clearances, gearbox oil levels, lubrication points)</p> <p>2.9 explain the functional checks that need to be carried out at operational speed (including stopping distances, brake function, handrail synchronisation with step-band, running direction is in line with the switch position, safety devices and auxiliary equipment operate correctly)</p> <p>2.10 explain the equipment operating and control procedures to be applied during the commissioning activity.</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
<p>2b Know how to commission escalator installations (continued)</p>	<p>2.11 explain the importance of running the equipment at operational speed to ensure satisfactory performance</p> <p>2.12 explain how to make adjustments to escalator components/assemblies to ensure that they function correctly</p> <p>2.13 describe the fault diagnostic techniques that can be used to help identify problems with the running of the escalator</p> <p>2.14 describe the measuring equipment used when checking escalator installations (such as linear measuring devices, electrical measuring instruments and self-diagnostic aids)</p> <p>2.15 explain how to check that tools and equipment are free from damage or defects, and are in a safe and usable condition</p> <p>2.16 explain the importance of completing all documentation following the commissioning activity, and how to generate them</p> <p>2.17 describe the types of problems associated with the commissioning activity, and explain how they can be overcome</p> <p>2.18 describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials</p>			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.19 describe the extent of their own authority, and explain whom they should report to if they have a problem that they cannot resolve.			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(if sampled)

Further information

Our customer service numbers are:

BTEC and NVQ	0844 576 0026
GCSE	0844 576 0027
GCE	0844 576 0025
The Diploma	0844 576 0028
DiDA and other qualifications	0844 576 0031

Calls may be recorded for training purposes.

Useful publications

Related information and publications include:

- *Centre Handbook for Edexcel QCF NVQs and Competence-based Qualifications* published annually
- Functional skills publications – specifications, tutor support materials and question papers
- *Regulatory Arrangements for the Qualification and Credit Framework* (published by Ofqual, August 2008)
- the current Edexcel publications catalogue and update catalogue.

Edexcel publications concerning the Quality Assurance System and the internal and standards verification of vocationally-related programmes can be found on the Edexcel website.

NB: Some of our publications are priced. There is also a charge for postage and packing. Please check the cost when you order.

How to obtain National Occupational Standards

Semta (Head Office)
14 Upton Road
Watford
WD18 0JT

Telephone: 01923 238441
Fax: 01923 256086
Email: customerservices@semta.org.uk

Professional development and training

Edexcel supports UK and international customers with training related to NVQ and BTEC qualifications. This support is available through a choice of training options offered in our published training directory or through customised training at your centre.

The support we offer focuses on a range of issues including:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing student-centred learning and teaching approaches
- building functional skills into your programme
- building effective and efficient quality assurance systems.

The national programme of training we offer can be viewed on our website (www.edexcel.com/training). You can request customised training through the website or by contacting one of our advisers in the Training from Edexcel team via Customer Services to discuss your training needs.

The training we provide:

- is active
- is designed to be supportive and thought provoking
- builds on best practice
- may be suitable for those seeking evidence for their continuing professional development.

Annexe A: Progression pathways

The Edexcel qualification framework for the Engineering sector

Level	General qualifications	Diplomas	BTEC vocationally-related qualifications	BTEC specialist qualification / professional	NVQ/ competence
8					
7					
6					We have too many qualifications to list in this space. Please refer to www.edexcel.com for further information.

Level	General qualifications	Diplomas	BTEC vocationally-related qualifications	BTEC specialist qualification/professional	NVQ/competence
5			<p>Edexcel BTEC Level 5 HND Diploma in Manufacturing Engineering</p> <p>Edexcel BTEC Level 5 HND Diploma in Mechanical Engineering</p> <p>Edexcel BTEC Level 5 HND Diploma in Operations Engineering</p> <p>Edexcel BTEC Level 5 HND Diploma in Electrical/Electronic Engineering</p> <p>Edexcel BTEC Level 5 HND Diploma in General Engineering</p> <p>Edexcel BTEC Level 5 HND Diploma in Automotive Engineering</p> <p>Edexcel BTEC Level 5 HND Diploma in Aeronautical Engineering</p>		<p>We have too many qualifications to list in this space. Please refer to www.edexcel.com for further information.</p>

Level	General qualifications	Diplomas	BTEC vocationally-related qualifications	BTEC specialist qualification/professional	NVQ/competence
4			<p>Edexcel BTEC Level 4 HNC Diploma in Manufacturing Engineering</p> <p>Edexcel BTEC Level 4 HNC Diploma in Mechanical Engineering</p> <p>Edexcel BTEC Level 4 HNC Diploma in Operations Engineering</p> <p>Edexcel BTEC Level 4 HNC Diploma in Electrical/Electronic Engineering</p> <p>Edexcel BTEC Level 4 HNC Diploma in General Engineering</p> <p>Edexcel BTEC Level 4 HNC Diploma in Automotive Engineering</p> <p>Edexcel BTEC Level 4 HNC Diploma in Aeronautical Engineering</p>		<p>We have too many qualifications to list in this space. Please refer to www.edexcel.com for further information.</p>

Level	General qualifications	Diplomas	BTEC vocationally-related qualifications	BTEC specialist qualification/professional	NVQ/competence
3		Edexcel Level 3 Diploma in Engineering	Edexcel Level 3 BTEC Certificate, Subsidiary Diploma, Diploma and Extended Diploma in Engineering Edexcel Level 3 BTEC Diploma and Extended Diploma in Mechanical Engineering Edexcel Level 3 BTEC Diploma and Extended Diploma in Manufacturing Engineering Edexcel Level 3 BTEC Diploma and Extended Diploma in Operations and Maintenance Engineering Edexcel Level 3 BTEC Diploma and Extended Diploma in Electrical/Electronic Engineering Edexcel Level 3 BTEC Diploma and Extended Diploma in Aeronautical Engineering		We have too many qualifications to list in this space. Please refer to www.edexcel.com for further information.

Level	General qualifications	Diplomas	BTEC vocationally-related qualifications	BTEC specialist qualification/professional	NVQ/competence
2	GCSE Engineering	Edexcel Level 2 Diploma in Engineering	Edexcel Level 2 BTEC Certificate, Extended Certificate and Diploma in Engineering		We have too many qualifications to list in this space. Please refer to www.edexcel.com for further information.
	GCSE Manufacturing				
1		Edexcel Level 1 Diploma in Engineering	Edexcel BTEC Level 1 Award, Certificate and Diploma in Engineering		We have too many qualifications to list in this space. Please refer to www.edexcel.com for further information.
Entry					

Annexe B: Quality assurance

Key principles of quality assurance

- A centre delivering Edexcel qualifications must be an Edexcel recognised centre and must have approval for qualifications that it is offering.
- The centre agrees as part of gaining recognition to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; the centre must abide by these conditions throughout the period of delivery.
- Edexcel makes available to approved centres a range of materials and opportunities to exemplify the processes required for effective assessment and provide examples of effective standards. Approved centres must use the guidance on assessment to ensure that staff who are delivering Edexcel qualifications are applying consistent standards.
- An approved centre must follow agreed protocols for: standardisation of assessors; planning, monitoring and recording of assessment processes; internal verification and recording of internal verification processes; and for dealing with special circumstances, appeals and malpractice.

Quality assurance processes

The approach to quality assured assessment is made through a partnership between a recognised centre and Edexcel. Edexcel is committed to ensuring that it follows best practice and employs appropriate technology to support quality assurance processes where practicable. Therefore, the specific arrangements for working with centres will vary. Edexcel seeks to ensure that the quality assurance processes that it uses do not place undue bureaucratic processes on centres and works to support centres in providing robust quality assurance processes.

The learning outcomes and assessment criteria in each unit within this specification set out the standard to be achieved by each learner in order to gain the qualification. Edexcel operates a quality assurance process, which is designed to ensure that these standards are maintained by all assessors and verifiers.

For the purposes of quality assurance all individual qualifications and units are considered as a whole. Centres offering these qualifications must be committed to ensuring the quality of the units and qualifications they offer, through effective standardisation of assessors and internal verification of assessor decisions. Centre quality assurance and assessment processes are monitored by Edexcel.

The Edexcel quality assurance processes will involve:

- gaining centre recognition and qualification approval if a centre is not currently approved to offer Edexcel qualifications
- annual visits to centres by Edexcel for quality review and development of overarching processes and quality standards. Quality review and development visits will be conducted by an Edexcel quality development reviewer
- annual visits by occupationally competent and qualified Edexcel Standards Verifiers for sampling of internal verification and assessor decisions for the occupational sector
- the provision of support, advice and guidance towards the achievement of National Occupational Standards.

Centres are required to declare their commitment to ensuring quality and appropriate opportunities for learners that lead to valid and accurate assessment outcomes. In addition, centres will commit to undertaking defined training and online standardisation activities.

Annexe C: Centre certification and registration

Edexcel Standards Verifiers will provide support, advice and guidance to centres to achieve Direct Claims Status (DCS). Edexcel will maintain the integrity of Edexcel QCF NVQs through ensuring that the awarding of these qualifications is secure. Where there are quality issues identified in the delivery of programmes, Edexcel will exercise the right to:

- direct centres to take actions
- limit or suspend certification
- suspend registration.

The approach of Edexcel in such circumstances is to work with the centre to overcome the problems identified. If additional training is required, Edexcel will aim to secure the appropriate expertise to provide this.

What are the access arrangements and special considerations for the qualification in this specification?

Centres are required to recruit learners to Edexcel qualifications with integrity.

Appropriate steps should be taken to assess each applicant's potential and a professional judgement made about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner within the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification. Centres should consult Edexcel's policy on learners with particular requirements.

Edexcel's policy on access arrangements and special considerations for Edexcel qualifications aims to enhance access to the qualifications for learners with disabilities and other difficulties (as defined by the 1995 Disability Discrimination Act and the amendments to the Act) without compromising the assessment of skills, knowledge, understanding or competence. Please refer to *Access Arrangements and Special Considerations for BTEC and Edexcel NVQ Qualifications* for further details. www.edexcel.com.

Annexe D: Additional requirements for qualifications that use the title NVQ within the QCF

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Purpose of document

- 1 The purpose of this document is to make clear what additional requirements are needed to assess and quality assure qualifications that use the title NVQ within the QCF.
- 2 When an SSC/SSB and awarding organisation wants to use the title NVQ in the naming of a qualification within the QCF, the awarding organisation is required to make sure this qualification is assessed and quality assured in accordance with these additional requirements and other requirements described in the SSC/SSB assessment strategy.
- 3 The aims of these additional requirements are to
 - ensure that all competence based qualifications that use the title NVQ within the QCF are
 - assessed consistently
 - quality assured consistently
 - maintain the integrity of qualifications that use the title NVQ within the QCF
 - establish the NVQ brand within the QCF
 - keep bureaucracy associated with assessment and quality assurance of qualifications that use the title NVQ within the QCF to a minimum.

Background

- 4 ¹ “At the heart of an NVQ is the concept of occupational competence; the ability to perform to the standards required in employment across a range of circumstances and to meet changing demands. NVQs are first and foremost about what people can do. They go beyond technical skills to include planning, problem solving, dealing with unexpected occurrences, working with other people and applying the knowledge and understanding that underpins overall competence”.
- 5 NVQs are based entirely on National Occupational Standards (NOS) developed by an SSC/SSB, which describe the competence needed in an occupational role.
- 6 Qualifications that use the title NVQ within the QCF must comply with the rules of combination determined by the SSC/SSB. Awarding organisations are not allowed to develop another qualification that does not use the title NVQ within the QCF, if it uses the same rules of combination as a qualification that does use the title NVQ within the QCF.
- 7 The QCF offers increased flexibility in the way occupational competence can be assessed and demonstrated. Qualifications that use the title NVQ in the title within the QCF are just one way of assessing and demonstrating occupational competence. SSCs/SSBs are free to work with their awarding organisations to agree what qualifications will be used to assess occupational competence. Qualifications that use the title NVQ within the QCF, are not a preferred method for assessing occupational competence and all qualifications accredited through the QCF have equal status.
- 8 When developing a qualification for the QCF, including qualifications that use the title NVQ within the QCF, an awarding organisation must be a recognised awarding organisation and must meet the Qualification Requirements in the *Regulatory Arrangements for the Qualifications and Credit Framework*, published by The Office of the Qualifications and Examinations Regulator (Ofqual) in August 2008.
- 9 The qualification regulators confirmed that a group of SSCs and SSBs would be free to develop specific, additional requirements about the way in which qualifications that use the title NVQ within the QCF will be assessed and quality assured. For those recognised awarding organisations that want to assess occupational competence through the use of qualifications that use the title NVQ within the QCF, it has been agreed by SSCs and SSBs that the following additional requirements must be met.

¹ *NCVQ's NVQ Criteria and Guidance* 1995.

Additional requirements for qualifications that use the title NVQ within the QCF

Introduction

- 10 Qualifications that use the title NVQ within the QCF must be assessed and quality assured in accordance with the following additional requirements.

Assessment requirements

- 11 When a qualification uses the title NVQ within the QCF, awarding organisations are required to make sure their recognised assessment centres understand how learners are to be assessed.
- 12 Assessment methodologies must meet the assessment strategy developed in partnership between the relevant SSC or SSB and awarding organisations for the qualification. The assessment strategy must be published and made available separately and will include the requirements for assessment of qualifications that use the title NVQ within the QCF. The assessment criteria for each unit will be part of the units that make up the qualification.
- 13 Learners must complete real work activities in order to produce evidence to demonstrate they have met the NOS and are occupationally competent.
- 14 When a learner cannot complete a real work activity, simulation is allowed.
- 15 Simulation is allowed when
- a learner is required to complete a work activity that does not occur on a regular basis and therefore opportunities to complete a particular work activity do not easily arise
 - a learner is required to respond to a situation that rarely occurs, such as responding to an emergency situation
 - the safety of a learner, other individuals and/or resources will be put at risk.
- 16 When simulation is used, assessors must be confident that the simulation replicates the workplace to such an extent that learners will be able to fully transfer their occupational competence to the workplace and real situations.
- 17 Units that must not be assessed by simulation must be identified by the SSC/SSB in the assessment strategy for the qualification or family of qualifications.

- 18 Learners must be assessed by assessors:
- who are occupationally competent in the occupational areas they are assessing where they have sufficient and relevant technical/occupational competence in the unit, at or above the level of the unit being assessed and as defined by the assessment strategy for that qualification
 - ²who must hold or be working towards a suitable assessor qualification to confirm they understand assessment and how to assess learners
 - must be fully conversant with the unit(s) against which the assessments and verification are to be undertaken.
- 19 All assessors must carry out assessment to the standards specified in the A units.
- 20 All assessment decisions made by a trainee assessor must be checked by a qualified assessor or an assessor recognised by an awarding organisation.
- 21 Trainee assessors must have a plan, which is overseen by the recognised assessment centre, to achieve the relevant assessor qualification(s) within an agreed timescale.

² Currently an assessor could hold unit A1 and/or unit A2. Or from the past unit D32 and/or unit D33. SSCs also identify other suitable equivalent qualifications.

Quality assurance requirements

- 22 When a qualification uses the title NVQ within the QCF, awarding organisations are required to make sure their recognised assessment centres understand how the qualification will be quality assured.
- 23 Qualifications that use the title NVQ within the QCF, must be verified:
- internally by an internal verifier, who is accountable to the assessment centre
 - externally by an external verifier, who is accountable to the awarding organisation or an agent of the awarding organisation.
- 24 With reference to internal verification, internal verifiers must:
- ³hold or be working towards a suitable internal verifier qualification to confirm they understand how to internally verify assessments
 - have sufficient and relevant technical/occupational familiarity in the unit(s) being verified
 - be fully conversant with the standards and assessment criteria in the units to be assessed
 - understand the awarding organisation's quality assurance systems and requirements for this qualification.
- 25 Trainee internal verifiers must have a plan, which is overseen by the recognised assessment centre, to achieve the internal verifier qualification within an agreed timescale.
- 26 With reference to external verification, external verifiers must:
- ⁴hold or be working towards a suitable external verification qualification to confirm they understand and are able to carry out external verification
 - have no connections with the assessment centre, in order to maintain objectivity
 - have sufficient and relevant technical/occupational understanding in the unit(s) being verified
 - be fully conversant with the standards and performance criteria in the units to be assessed
- understand the awarding organisation's quality assurance systems for this qualification.
- 27 Trainee external verifiers must have a plan, which is overseen by the awarding organisation, to achieve the external verifier qualification within an agreed timescale.

³ Currently an internal verifier needs to hold unit V1. Or from the past unit D34. SSCs also identify other suitable equivalent qualifications.

⁴ Currently an external verifier needs to hold unit V2. Or from the past unit D35.

- 28 Awarding organisations must decide the frequency of external monitoring activities. Any decision must be based on:
- the risks associated with a qualification that is designed to help a learner demonstrate occupational competence
 - an evaluation of the centre's performance and past record.
- 29 Awarding organisations will have in place suitably constituted audit processes, which are supported by naturally occurring quality assurance and monitoring systems that already exist in workplace assessment environments.



Semta

Engineering

NVQ Level 2, 3 and 4

QCF Unit Assessment Strategy

Version 1. 16th March 2010

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Introduction

[Semta], the Sector Skills Council for the Science Engineering Manufacturing Technologies Sector, has produced this QCF Unit Assessment Strategy to:

- assist Assessors, Internal Verifiers and External Verifiers
- encourage and promote consistent assessment of NVQ units
- promote cost effective assessment plans.

This document also provides definitions for:

- the qualifications and experience required for Assessors and Verifiers
- the assessment environment and notes on simulation/replication.
- access to units.

and requirements relating to:

- carrying out assessments
- performance evidence
- assessing knowledge and understanding.

The importance and value in which employers and learners place on undertaking NVQ units will provide a key measure of [Semta's] success with this unit assessment strategy. Another key success factor will be [Semta's] partnership with the relevant Awarding Organisations.

Assessor Requirements to Demonstrate Effective Assessment Practice

Assessment must be carried out by competent Assessors who hold, or are working towards, the nationally recognised Assessor units A1 and/or A2 as appropriate to the assessment being carried out. Assessors that hold units D32 and/or D33 must demonstrate that they are applying the assessment principles and practices set down in A1 and/or A2 as appropriate to the assessment being carried out.

Assessor Technical Requirements

Assessors must be able to demonstrate that they have verifiable, relevant and sufficient technical competence to evaluate and judge performance and knowledge evidence requirements as set out in the relevant QCF unit learning outcomes and associated assessment criteria.

This will be demonstrated either by holding a relevant technical qualification or by proven industrial experience of the technical areas to be assessed. The assessor's competence must, at the very least, be at the same level as that required of the learner(s) in the units being assessed.

Assessors must also be:

fully conversant with the Awarding Organisation's Assessment methodology documentation used for the QCF NVQ units against which the assessments and verification are to be carried out, other relevant documentation and system and procedures to support the QA process.

Verifier Requirements

Internal Verifiers must hold, or be working towards, the nationally recognised Internal Verifier unit V1 and would be expected to be familiar with, and preferably hold, the nationally recognised Assessor units. Internal Verifiers that hold unit D34 must demonstrate that they are applying the verification principles and practices set down in V1.

External Verifiers must hold, or be working towards, the nationally recognised External Verifier unit V2 and would be expected to be familiar with, and preferably hold, the nationally recognised Assessor units, and Internal Verifier unit. External Verifiers that hold unit D35 must demonstrate that they are applying the verification principles and practices set down in V2.

Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the QCF NVQ units against which the assessments and verification are to be carried out, the appropriate Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation, systems and procedures within which the assessment and verification is taking place.

Specific Technical Requirements for Internal and External Verifiers

Internal and External Verifiers of this qualification must be able to demonstrate that they have verifiable, sufficient and relevant industrial experience, and must have a working knowledge of the processes, techniques and procedures that are used in the relevant sector/occupation.

The tables on the following page show the recommended levels of technical competence for Assessors, Internal Verifiers, and External Verifiers.

Technical Requirements for Assessors and Verifiers

Position	Prime activity requirements	Support activity requirements	Technical requirements (see notes)
Assessor	Assessment Skills	IV Systems	Technical <i>competence</i> in the areas covered by the QCF units being assessed
Internal Verifier	Verification Skills	Assessment Knowledge	Technical <i>understanding</i> of the areas covered by the qualifications
External Verifier	Verification skills	Assessment Understanding	Technical <i>awareness</i> of the areas covered by the qualifications

Notes

1. Technical competence is defined here as a combination of practical skills, knowledge, and the ability to apply both of these, in familiar and new situations, within a real working environment.
2. Technical understanding is defined here as having a good understanding of the technical activities being assessed, together with knowledge of relevant Health & Safety implications and requirements of the assessments.
3. Technical awareness is defined here as a general overview of the subject area, sufficient to ensure that assessment and portfolio evidence are reliable, and that relevant Health and Safety requirements have been complied with.
4. The competence required by the assessor, internal verifier and external verifier, in the occupational area being assessed, is likely to exist at three levels as indicated by the shaded zones in the following table.

Technical Competence required by:	An ability to <i>discuss</i> the general principles of the competences being assessed	An ability to <i>describe</i> the practical aspects of the competence being assessed	An ability to <i>demonstrate</i> the practical competences being assessed
Assessor			
Internal Verifier			
External Verifier			

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 learners' competence.
- Simulations/replications will require prior approval from the specific warding 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 reasons 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 takes the same form as in the workplace.

Access to Assessment

There are no entry qualifications or age limits required by learners to undertake the NVQ units unless this is a legal requirement of the process or the environment. Assessment is open to any learner who has the potential to achieve the assessment criteria set out in the units.

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

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 learner's 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.

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 may be 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 learner's 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 learner's knowledge and understanding (and the handling of contingency situations) is not apparent from performance evidence, it must be assessed by other means and be supported by suitable evidence.

Knowledge and understanding can be demonstrated in a number of different ways. 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. Awarding Organisations may choose other methods, which must be supported by a suitable rationale

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.

Awarding Organisations may choose other methods, which must be supported by a suitable rationale.

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.

Quality Control of Assessment

General

There are two major points where an Awarding Organisation interacts with the Centre in relation to the External Quality Control of Assessment for a qualification and these are:

- approval – when a Centre take on new qualifications, the Awarding Organisation, normally through an External Verifier (EV) ensures that the Centre is suitably equipped and prepared to deliver the new qualification
- monitoring – throughout the ongoing delivery of the qualification the Awarding Organisation, through EV monitoring and other mechanisms must maintain the quality and consistency of assessment of the qualification .

Approval

In granting Approval, the Awarding Organisation, normally through its External Verifiers (EV) must ensure that the prospective Centre:

- meets any procedural requirements specified by the Awarding Organisation
- has sufficient and appropriate physical and staff resources
- meets relevant health and safety and/or equality and access requirements
- has a robust plan for the delivery, assessment and QA for the qualifications.

Awarding Organisation's may decide to visit the Centre to view the evidence provided.

The Awarding Organisation must have a clear rationale for the method(s) deployed.

Monitoring

The Awarding Organisation, through EV monitoring and other mechanisms must ensure:

- that a strategy is developed and deployed for the ongoing Awarding Organisation monitoring of the Centre. This strategy must be based on an active risk assessment of the Centre. In particular the strategy must identify the learner, assessor and IV sampling strategy to be deployed and the rationale behind this
- that the Centre's internal quality assurance processes are effective in learner assessment
- that sanctions are applied to a Centre where necessary and that corrective actions are taken by the Centre and monitored by the Awarding Organisation/EV
- that reviews of Awarding Organisation's external auditing arrangements are undertaken.

Awarding Organisations are required to provide to SEMTA, on request, details of the strategies, rationales and reviews detailed above.

Additional Notes:

a) It is recognised that some Awarding Organisations provide supplementary guidance and documentation to centres to support the quality of assessment and verification practice of N/SVQs.

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