QUALIFICATION HANDBOOK

Level 4 NVQ Extended Diploma in Engineering Manufacture (9330-01)

September 2018 version 1.1

City & Guilds

Qualification at a glance

Subject area	**Engineering**
City & Guilds number	9330-01
Age group approved	18+ 19+
Entry requirements	N/A
Assessment	Portfolio
Fast track	N/A
Support materials	Handbook Learning Assistant Recording forms PEO Unit pack (containing units 704-773)
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Accreditation number
Level 4 NVQ Extended Diploma in Engineering Manufacture	9330-01	600/9529/5

Version and date	Change detail	Section
1.1 September 2018	Change from a seven to a nine	Unit 401 assessment criteria 2.3

Contents

1 Introduction

This document tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	This qualification is for candidates who work or want to work as mechanical, electrical or electronic engineers in positions such as • Manufacturing Senior Technician • Senior Quality Technician • Electronics Development Senior Technician
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the manufacturing sector.
Is the qualification part of a framework or initiative?	It is the competence qualification in the Level 4 Advanced Manufacturing Apprenticeship Framework (England).
Who did we develop the qualification with?	It was developed in association with SEMTA, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
What opportunities for progression are there?	It allows candidates to progress into employment or to the following qualifications: • City & Guilds Advanced Manufacturing Apprenticeship • City & Guilds Professional Recognition Awards. • ILM Level 4 or Level 5 Qualifications in Management • Foundation Degree or other higher education qualifications This qualification may also provide preparation towards professional registration as an Engineering Technician and progression to Incorporated Engineer registration.

Structure

To achieve the **Level 4 NVQ Extended Diploma in Engineering Manufacturing,** learners **must** achieve a minimum of 107 credits overall:

Credits from mandatory units	**5 credits** from the mandatory unit (401).

Credits from optional units	Learners **must** achieve either:
	• a minimum of **27 credits** and **3 units** from optional group A (704-761, 765-773), **or**:
	• a minimum of **51 credits must** be achieved from optional group B; this **must** be achieved from:
	  o **11 credits** and **1** unit from group B1 (704, 732, 761),
	  o **16 credits** and **2** units from group B2 (762-764) and
	  o **24 credits** and **2** units from group B3 (765-768).

	Learners **must** also achieve a minimum total of **75** credits and **11 units** from optional groups C-E (units 402-513), including: • a minimum of **48 credits (3 units)** from optional group C (units 402-466) • a minimum of **3 credits (1 unit)** from either optional groups D or E (units 467-513) • a minimum of **24 credits (from at least 7 units)** which can be taken from optional groups C, D and E (units 402-513);
Barred Units:	Barred units: • If unit 408 is selected units 415 or 421 cannot be included in the learners choice • If unit 426 is selected unit 449 cannot be included in the learners choice • If unit 428 is selected unit 446 cannot be included in the learners choice • If unit 433 is selected unit 448 cannot be included in the learners choice • If unit 434 is selected unit 450 cannot be included in the learners choice • If unit 437 is selected units 495 to 513 cannot be included in the learners choice • If unit 454 is selected units 458 to 466 cannot be included in the learners choice • If unit 456 is selected units 424 or 425 cannot be included in the learners choice • Only one unit from 490 and 491 may be selected in the learners choice of units • If the pathway optional group B1 (704-761, 765-773) is undertaken: o Only one unit from 704, 732 and 761

may be included in the learners choice of three units.

- If unit 765 is selected units 705, 706, 708, 711, 712, 715, 716, 717 cannot be included in the learners choice of three units.
- If unit 766 is selected units 710, 722, 723, 725, 726, 727, 728, 729, 730, 734 cannot be included in the learners choice of three units.
- If unit 767 is selected units 733, 735, 736, 740 cannot be included in the learners choice of three units.
- If unit 768 is selected units 719, 721, 737, 738, 739, 740, 758, 759 cannot be included in the learners choice of three units.

Level 4 NVQ Extended Diploma in Engineering Manufacturing

Unit accreditation number	City & Guilds unit number	Unit title	Credit value	Excluded combination of units (if any)
Mandatory				
A/601/5013	401	Complying with statutory regulations and organisational safety requirements	5	
Optional group A				
F/504/6348	Unit 704	Producing Mechanical Engineering Drawings using a CAD System	11	732, 761
J/504/6349	Unit 705	Producing Components using Hand Fitting Techniques	14	765
F/504/6351	Unit 706	Producing Mechanical Assemblies	15	765
L/504/6353	Unit 707	Forming and Assembling Pipework Systems	14	
R/504/6354	Unit 708	Carrying Out Aircraft Detail Fitting Activities	14	765
L/504/6367	Unit 709	Installing Aircraft Mechanical Fasteners	11	
L/504/6370	Unit 710	Producing Aircraft Detail Assemblies	14	766

Y/504/6372	Unit 711	Preparing and Using Lathes for Turning Operations	15	765
K/504/6375	Unit 712	Preparing and Using Milling Machines	15	765
T/504/6377	Unit 713	Preparing and Using Grinding Machines	15	
F/504/6379	Unit 714	Preparing and Proving CNC Machine Tool Programs	14	
F/504/6382	Unit 715	Preparing and Using CNC Turning Machines	14	765
L/504/6384	Unit 716	Preparing and Using CNC Milling Machines	14	765
D/504/6387	Unit 717	Preparing and Using CNC Machining Centres	14	765
D/504/6390	Unit 718	Preparing and Using Industrial Robots	14	
T/504/6394	Unit 719	Maintaining Mechanical Devices and Equipment	14	768
J/504/6397	Unit 720	Assembling and Testing Fluid Power Systems	14	
F/504/6401	Unit 721	Maintaining Fluid Power Equipment	14	768
J/504/6402	Unit 722	Producing Sheet Metal Components and Assemblies	14	766
L/504/6403	Unit 723	Producing Platework Components and Assemblies	14	766
R/504/6404	Unit 724	Cutting and Shaping Materials using Thermal Cutting Equipment	14	
Y/504/6405	Unit 725	Preparing and Proving CNC Fabrication Machine Tool Programs	14	766
D/504/6406	Unit 726	Preparing and Using CNC Fabrication Machinery	14	766
K/504/6408	Unit 727	Preparing and Using Manual Metal Arc Welding Equipment	15	766

M/504/6409	Unit 728	Preparing and Using Manual TIG or Plasma-arc Welding Equipment	15	766
H/504/6410	Unit 729	Preparing and Using Semi-automatic MIG, MAG and Flux cored arc Welding Equipment	15	766
Y/504/6419	Unit 730	Preparing and Using Manual Oxy/fuel Gas Welding Equipment	14	766
L/504/6420	Unit 731	Preparing and Using Manual Flame Brazing and Braze Welding Equipment	11	
R/504/6421	Unit 732	Producing Electrical or Electronic Engineering Drawings using a CAD System	11	
Y/504/6422	Unit 733	Wiring and Testing Electrical Equipment and Circuits	14	767
D/504/6423	Unit 734	Forming and Assembling Electrical Cable Enclosure and Support Systems	13	766
H/504/6424	Unit 735	Assembling, Wiring and Testing Electrical Panels/Components Mounted in Enclosures	14	767
K/504/6425	Unit 736	Assembling and Testing Electronic Circuits	14	767
M/504/6426	Unit 737	Maintaining Electrical Equipment/Systems	15	768
T/504/6427	Unit 738	Maintaining Electronic Equipment/Systems	15	768
A/504/6428	Unit 739	Maintaining and Testing Process Instrumentation and Control Devices	15	768
F/504/6429	Unit 740	Wiring and Testing Programmable Controller Based Systems	15	767, 768
T/504/6430	Unit 741	Using Wood for Pattern, Modelmaking and Other Engineering Applications	15	

A/504/6431	Unit 742	Assembling Pattern, Model and Engineering Woodwork Components	14	
F/504/6432	Unit 743	Producing Composite Mouldings using Wet Lay-up Techniques	14	
L/504/6434	Unit 744	Producing Composite Mouldings using Pre-Preg Techniques	14	
R/504/6435	Unit 745	Producing Composite Mouldings using Resin Flow Infusion Techniques	14	
Y/504/6436	Unit 746	Producing Composite Assemblies	14	
D/504/6437	Unit 747	Producing Components by Rapid Prototyping Techniques	11	
H/504/6438	Unit 748	Producing and Preparing Sand Moulds and Cores for Casting	14	
K/504/6439	Unit 749	Producing and Preparing Molten Materials for Casting	14	
D/504/6440	Unit 750	Producing Cast Components by Manual Means	13	
H/504/6441	Unit 751	Fettling, Finishing and Checking Cast Components	11	
M/504/6443	Unit 752	Finishing Surfaces by Applying Coatings or Coverings	9	
T/504/6444	Unit 753	Finishing Surfaces by Applying Treatments	9	
A/504/6445	Unit 754	Carrying Out Heat Treatment of Engineering Materials	9	
F/504/6446	Unit 755	Carrying Out Hand Forging of Engineering Materials	9	
J/504/6447	Unit 756	Stripping and Rebuilding Motorsport Vehicles (Pre-Competition)	14	
L/504/6448	Unit 757	Inspecting a Motorsport Vehicle During a Competition	14	

R/504/6449	Unit 758	Diagnosing and Rectifying Faults on Motorsport Vehicle Systems (During Competition)	15	768
J/504/6450	Unit 759	Carrying out Maintenance Activities on Motorsport Vehicle Electrical Equipment	15	768
L/504/6451	Unit 760	Stripping and Rebuilding Motorsport Engines (Pre-Competition)	14	
R/504/6452	Unit 761	Producing CAD Models (Drawings) using a CAD System	11	704, 232
K/504/6456	Unit 765	General Machining, Fitting and Assembly Applications	12	705, 706, 708, 711, 712, 715, 716, 717
M/504/6457	Unit 766	General Fabrication and Welding Applications	12	710, 722, 723, 725, 726, 727, 728, 729, 730, 234
T/504/6458	Unit 767	General Electrical and Electronic Engineering Applications	12	733, 735, 736, 740
A/504/6459	Unit 768	General Maintenance Engineering Applications	12	719, 721, 737, 738, 739, 740, 758, 759
L/503/4056	Unit 769	Joining Public Service Vehicle Components by Mechanical Processes	11	
R/503/4057	Unit 770	Assembling Structural Sub Assemblies to Produce a Public Service Vehicle	14	
Y/503/4058	Unit 771	Fitting Sub Assemblies and Components to Public Service Vehicles	14	
R/503/7198	Unit 772	Preparing and Manoeuvring Armoured Fighting Vehicles (AFVs) for Maintenance and Transportation	14	

J/504/3404	Unit 773	Producing Composite Mouldings using Resin Film Infusion Techniques	14	
Optional group B1				
F/504/6348	Unit 704	Producing Mechanical Engineering Drawings using a CAD System	11	732, 761
R/504/6421	Unit 732	Producing Electrical or Electronic Engineering Drawings using a CAD System	11	
R/504/6452	Unit 761	Producing CAD Models (Drawings) using a CAD System	11	704, 232
Optional group B2				
Y/504/6453	Unit 762	Producing Engineering Project Plans	8	
D/504/6454	Unit 763	Using Computer Software Packages to Assist with Engineering Activities	8	
H/504/6455	Unit 764	Conducting Business Improvement Activities	8	
Optional group B3				
K/504/6456	Unit 765	General Machining, Fitting and Assembly Applications	12	705, 706, 708, 711, 712, 715, 716, 717
M/504/6457	Unit 766	General Fabrication and Welding Applications	12	710, 722, 723, 725, 726, 727, 728, 729, 730, 234
T/504/6458	Unit 767	General Electrical and Electronic Engineering Applications	12	733, 735, 736, 740
A/504/6459	Unit 768	General Maintenance Engineering Applications	12	719, 721, 737, 738, 739, 740, 758, 759
Optional group C				
J/505/0952	402	Identify and Define Areas of Engineering Research	16	
L/505/0953	403	Develop a Research Methodology for Engineering	16	

R/505/0954	404	Propose and Specify Engineering Research	16	
L/505/0936	405	Undertake Engineering Research	16	
Y/505/0955	406	Evaluate the Results of Engineering Research	16	
F/505/0934	407	Identify Engineering Design Requirements of Clients	16	
Y/505/0938	408	Establish an Engineering Design Brief	16	415, 421
D/505/0956	409	Develop a Strategy for the Engineering Design Process	16	
D/505/0939	410	Create Engineering Designs	16	
R/505/0940	411	Evaluate Engineering Designs	16	
Y/505/1006	412	Contribute to a Team Feasibility Review of a New Product Design	16	
H/505/1008	413	Control the New Product Design Change Process	16	
K/505/1009	414	Plan and Control New Product Design Benchmarking Activities	16	
H/505/1011	415	Establish New Product Development and Introduction Brief	16	
D/505/1010	416	Produce and Evaluate Conceptual Design Options for New Products	16	
K/505/1012	417	Verify New Product Designs using a Computer Model	16	
L/505/1018	418	Verify New Product Designs using a Physical Model	16	
T/505/1045	419	Produce New Product Designs for Manufacture and Assembly	16	

J/505/1048	420	Plan and Control New Product Manufacturing Process Benchmarking Activities	16	
L/505/1049	421	Establish Manufacturing Process Design Brief for New Product Introduction	16	
F/505/1050	422	Develop a New Product Manufacturing Process Design Strategy	16	
J/505/1051	423	Develop a New Product Manufacturing Process Flow and Floor Plan Layout	16	
R/505/1053	424	Plan and Manage the Installation of the New Product Manufacturing Process	16	
T/505/1059	425	Commission a New Product Manufacturing Process	16	
A/505/0933	426	Solve Engineering or Manufacturing Problems	16	449
T/505/0963	427	Undertake Project Management Activities	16	
Y/505/0941	428	Determine the Requirements for Engineering Activities	16	446
J/505/0935	429	Produce Engineering Specifications	16	
D/505/0942	430	Specify Methods and Procedures to Achieve Engineering Requirements	16	
H/505/0943	431	Schedule Engineering Activities	16	
K/505/0944	432	Obtain Resources for the Implementation of Engineering Activities	16	
M/505/0945	433	Implement Engineering Processes	16	448

T/505/0946	434	Monitor and Evaluate Engineering Processes	16	450
F/505/0951	435	Provide technical advice and guidance on engineering or manufacturing requirements	16	
J/505/0949	436	Implement Quality Assurance Methods and Procedures	16	
A/505/0950	437	Improve the Quality of Engineering Products or Processes	16	495 to 513
F/505/0948	438	Specify Risk Reduction Methods and Procedures	16	
A/505/0947	439	Evaluate Engineering Risk Assessments	16	
K/505/0961	440	Investigate Incidents Relating to Engineering Activities	16	
H/505/0957	441	Configure Engineering Products, Processes or Facilities	16	
K/505/0958	442	Propose Decommissioning of Engineering Products, Processes or Facilities	16	
M/505/0959	443	Propose Decommissioning of Engineering Products, Processes or Facilities	16	
H/505/0960	444	Plan and Decommission Engineering Equipment, Processes or Facilities	16	
M/505/0962	445	Commission Engineering Products, Processes or Facilities	16	
D/505/0987	446	Determine Welding and Related Technical Requirements to Achieve Objectives	16	
H/505/0988	447	Plan Welding Production Resources and Activities	16	
K/505/0989	448	Implement Welding Production Methods and Procedures	16	

D/505/0990	449	Solve Welding Problems in Production	16	
H/505/0991	450	Monitor Welding Activities in Production	16	
K/505/0992	451	Inspect Welded Components or Structures for Visual Quality and Dimensional Accuracy	16	
L/505/0967	452	Lead Welding and Fabrication Activities	16	
R/505/0968	453	Lead Rail Welding Activities	16	
A/505/0964	454	Lead Maintenance Activities	16	458 to 466
F/505/0965	455	Lead Mechanical Manufacturing or Inspection Activities	16	
J/505/0966	456	Lead Installation or Commissioning Activities	16	424, 425
Y/505/0969	457	Lead Electrical/Electronic Product Manufacturing or Testing Activities	16	
L/505/0970	458	Carry Out the Testing and Calibration of Instrumentation Control Equipment and Circuits	16	
R/505/0971	459	Carry out Maintenance Activities on Mechanical Equipment	16	
Y/505/0972	460	Carry out Maintenance Activities on Electrical Equipment	16	
D/505/0973	461	Carry out Maintenance Activities on Fluid Power Equipment	16	
H/505/0974	462	Carry out Maintenance Activities on Instrumentation and Control Equipment	16	

K/505/0975	463	Carry out Maintenance Activities on Mechanical Equipment within an Engineered System	16	
M/505/0976	464	Carry out Maintenance Activities on Electrical Equipment within an Engineered System	16	
A/505/0978	465	Carry out Maintenance Activities on Fluid Power Equipment within an Engineered System	16	
F/505/0979	466	Carry out Maintenance Activities on Process Controller Equipment within an Engineered System	16	
Optional group D				
F/600/9682	467	Build, support and manage a team	4	
R/600/9587	468	Develop, maintain and review personal networks	4	
L/600/9622	469	Review risk management processes in own area of responsibility	3	
T/600/9601	470	Provide leadership and direction for own area of responsibility	5	
H/600/9609	471	Ensure compliance with legal, regulatory, ethical and social requirements	5	
M/600/9659	472	Implement change in own area of responsibility	6	
D/600/9690	473	Support individuals to develop and take responsibility for their performance	4	
H/600/9691	474	Know how to follow disciplinary procedures	4	
K/600/9692	475	Managing grievance procedures	3	

M/600/9693	476	Support the management of redundancies in own area of responsibility	3	
K/600/9661	477	Develop working relationships with colleagues and stakeholders	4	
M/600/9676	478	Support learning and development within own area of responsibility	5	
F/600/9679	479	Address performance problems affecting team members	3	
H/600/9738	480	Manage a tendering process	4	
L/600/9703	481	Develop and implement a risk assessment plan in own area of responsibility	6	
K/600/9711	482	Manage physical resources	3	
M/600/9712	483	Manage the environmental impact of work activities	5	
Y/600/9798	484	Prepare for and support quality audits	4	
K/600/9790	485	Develop and implement marketing plans	6	
M/600/9791	486	Analyse the market in which your organisation operates	5	
Y/600/9588	487	Develop and evaluate operational plans for own area of responsibility	6	
A/600/9793	488	Manage the achievement of customer satisfaction	5	
H/600/9674	489	Plan, allocate and monitor work in own area of responsibility	5	
T/601/2552	490	Manage budgets	5	491
J/601/2552	491	Agree a budget	4	490
H/601/2560	492	Make decisions in a business environment	4	
K/601/2561	493	Negotiate in a business environment	7	

F/601/2565	494	Prepare specifications for contracts	5	
Optional group E				
F/600/5406	495	Leading workplace organisation activities	10	
M/600/5420	496	Leading continuous improvement (Kaizen) activities	14	
M/600/5434	497	Leading the development of visual management systems	9	
K/600/5447	498	Leading the creation of flexible production and manpower systems	7	
M/600/5563	499	Leading value stream mapping (VSM) activities	13	
J/600/5665	500	Leading the carrying out of statistical process control procedures (SPC)	8	
A/600/5713	501	Leading value management (value engineering & value analysis) activities	11	
L/600/5733	502	Leading potential failure modes and effects analysis (FMEA) activities	9	
R/600/5748	503	Leading measurement systems analysis (MSA) activities	9	
L/600/5862	504	Carrying out design of experiments (DOE)	9	
K/600/5867	505	Leading mistake/error proofing (POKA YOKE) activities	9	
J/600/5875	506	Applying quality function deployment (QFD)	9	
F/600/5888	507	Leading the creation of standard operating procedures	8	
D/600/5896	508	Leading the application of Six Sigma methodology to a project	14	
T/600/5905	509	Leading Six Sigma process mapping activities	14	

T/600/5919	510	Leading the carrying out of basic statistical analysis	10	
Y/600/5931	511	Leading the application of Six Sigma metrics to a project	9	
R/600/5944	512	Leading the production of a characteristic selection matrix	9	
L/600/5957	513	Leading the carrying out of capability studies	14	

2 Centre requirements

Approval

There is no fast track approval for this qualification; existing centres who wish to offer this qualification must use the **standard** Qualification Approval Process.

To offer this qualification, new centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual - Supporting Customer Excellence* for further information.

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

Resource requirements

Centre staffing

Staff delivering this qualification must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the area for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Centre staff may undertake more than one role, eg tutor and assessor or internal quality assurer, but cannot quality assure their own assessments.

Assessors and internal verifiers

Assessment must be carried out by competent Assessors that as a minimum must hold the QCF Level 3 Award in Assessing Competence in the Work Environment. Current and operational Assessors that hold units D32 and/or D33 or A1 and/or A2 as appropriate to the assessment being carried out, will not be required to achieve the QCF Level 3 Award as they are still appropriate for the assessment requirements set out in this Unit Assessment Strategy. However, they will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace assessment to the most up to date National Occupational Standards (NOS).

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.

Internal quality assurance (Internal Verification) must be carried out by competent Verifiers that as a minimum must hold the QCF Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practices. Current and operational Internal Verifiers that hold internal verification units V1 or D34 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment.

Internal verifiers of this qualification must be able to demonstrate that 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 table below shows the recommended levels of technical competence for assessors and internal verifiers.

Position	**Prime activity requirements**	**Support activity requirements**	**Technical Requirements**
Assessor	Assessment Skills	IV Systems	Technical **competence** in the areas covered by the QCF units being assessed
Internal Verifier	Verification Skills	Assessment Knowledge	Technical **understanding** of the areas covered by the qualifications

Continuing professional development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.

Candidate entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

Age restrictions

City & Guilds cannot accept any registrations for candidates under 16 as this qualification is not approved for under 16s.

3 Delivering the qualification

Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- if the candidate has any specific training needs
- support and guidance they may need when working towards their qualification
- any units they have already completed, or credit they have accumulated which is relevant to the qualification
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate and the responsibilities of the centre. This information can be recorded on a learning contract.

Recording documents

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

City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence learners' progress towards achieving qualifications. Further details are available at: **www.cityandguilds.com/eportfolios**.

4 Assessment

Assessment of the qualification

Candidates must:

- have a completed portfolio of evidence for each unit

Assessment strategy

This qualification is subject to the Engineering NVQ Level 2, 3 and 4 QCF Unit Assessment Strategy written by SEMTA (version 4.1 January 2011) **http://semta.org.uk/employers/services1/work-based-learning/qualifications/**

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience or qualifications which have already been achieved to contribute to a new qualification.

5 Units

Availability of units

This handbook contains the units that are specific to this qualification; units 401-513. To obtain the unit pack containing units 704-773, which are taken from the City & Guilds 7682 Level 2 NVQ Diploma in Performing Engineering Operations, visit www.cityandguilds.com and the 9330 qualification webpage.

The following units can also be obtained from the City & Guilds website; they are also on the Register of Regulated qualifications: **www.register.ofqual.gov.uk**

Structure of units

These units each have the following:

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

Unit 401 Complying with statutory regulations and organisational safety requirements

UAN:	**A/601/5013**
Level:	2
Credit value:	5
GLH:	35
Relationship to NOS:	This unit has been derived from national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment. The learner will be expected to comply with all relevant regulations that apply to their area of work, as well as their general responsibilities as defined in the Health and Safety at Work Act. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises. The learner will also be required to identify the hazards and risks that are associated with their job. Typically, these will focus on their working environment, the tools and

equipment that they use, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual lifting and carrying techniques.

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

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

Learning outcome
The learner will: 1. comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 1.1 comply with their duties and obligations as defined in the health and safety at work act 1.2 demonstrate their understanding of their duties and obligations to health and safety by: a. applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act b. identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: bi. eye protection and personal protective equipment (PPE) bii. COSHH regulations biii. risk assessments c. identifying the warning signs and labels of the main groups of hazardous or dangerous substances d. complying with the appropriate statutory regulations at all times 1.3 present themselves in the workplace suitably prepared for the activities to be undertaken

1.4 follow organisational accident and emergency procedures
1.5 comply with emergency requirements, to include:
   a. identifying the appropriate qualified first aiders and the location of first aid facilities
   b. identifying the procedures to be followed in the event of injury to themselves or others
   c. following organisational procedures in the event of fire and the evacuation of premises
   d. identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment
1.6 recognise and control hazards in the workplace
1.7 identify the hazards and risks that are associated with the following:
   a. their working environment
   b. the equipment that they use
   c. materials and substances (where appropriate) that they use
   d. working practices that do not follow laid-down procedures
1.8 use correct manual lifting and carrying techniques
1.9 demonstrate one of the following methods of manual lifting and carrying:
   a. lifting alone
   b. with assistance of others
   c. with mechanical assistance
1.10 apply safe working practices and procedures to include:
   a. maintaining a tidy workplace, with exits and gangways free from obstruction
   b. using equipment safely and only for the purpose intended
   c. observing organisational safety rules, signs and hazard warnings
   d. taking measures to protect others from any harm resulting from the work that they are carrying out

Learning outcome

The learner will:

2. know how to comply with statutory regulations and organisational safety requirements

Assessment criteria

The learner can:

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)
2.2 describe the specific regulations and safe working practices and procedures that apply to their work activities
2.3 describe the warning signs for the nine main groups of hazardous substances defined by classification, packaging and labelling of dangerous substances regulations

2.4	explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed
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)
2.6	describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace
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)
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)
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
2.10	explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured
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
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
2.13	describe the protective clothing and equipment that is available for their areas of activity
2.14	explain how to safely lift and carry loads, and the manual and mechanical aids available
2.15	explain how to prepare and maintain safe working areas; the standards and procedures to ensure good housekeeping
2.16	describe the importance of safe storage of tools, equipment, materials and products
2.17	describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 402 Identify and Define Areas of Engineering Research

UAN:	**J/505/0952**
Level:	4
Credit value:	6
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 21 Identify and define areas of engineering research (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to identify and define areas of engineering research, in accordance with company procedures. The learner will be required to identify and examine information from a wide range of internal and/or external sources, as appropriate, and to define the research problem with a clear rationale. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful identification and specification of engineering research activities, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will be fully conversant with organisational procedures and systems, and will understand engineering research principles, processes and methodology, as well as patents, copyright and intellectual property issues. The learner will also be aware of research issues specific to their engineering sector or

discipline, and will understand risk analysis and assessment principles.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. identify and define areas of engineering research
Assessment criteria
The learner can: 1.1 carry out all of the following activities in identifying and defining areas of research: a. choose area/s to be researched, based on a current problem or need b. take account of any previous research or relevant existing materials c. review the availability of expertise for the research being considered d. evaluate the potential for practical exploitation of the research e. evaluate the potential for payback on predicted costs of the research 1.2 identify the rationale for research to be undertaken, using two of the following potential problem areas: a. design requirement/limitation b. product function c. material problem d. customer concerns e. manufacturing methods and procedures f. technological advance g. organisational procedures h. new design methods and/or techniques i. product aesthetics j. other (to be specified) 1.3 identify engineering problems and issues, together with their implications for the organisation 1.4 obtain accurate information on any relevant completed or current research 1.5 review and consider information obtained from four of the following sources: a. company data b. the internet c. engineering associations or institutions d. company procedures

e. other organisations
f. technical data (such as journals, research, papers)
g. statistical data
h. regulatory/legal requirements
i. libraries
j. other sources

1.6 assess the contribution of the research that has been undertaken

1.7 identify any gaps in the research that might require further action

1.8 identify and define areas of research, taking into account three of the following:

a. British, European or International standards, directives or codes of practice
b. health, safety and environmental requirements
c. equipment manufactures operating specification/range
d. organisational guidelines and procedures
e. recognised compliance agency/body standards, directives or codes of practice
f. other (to be specified)

1.9 define clearly the research problem and provide a rationale for undertaking the research

1.10 identify clearly any risks, benefits, and constraints associated with undertaking the research

1.11 consider the benefits and constraints of four of the following when developing areas of research:

a. spin-off products
b. organisational capability
c. availability of time
d. commercial implications
e. cost of resources
f. changes in technology
g. prestige
h. personnel capabilities

1.12 consult with colleagues on the feasibility and desirability of the research

1.13 review the outcomes of the identification process, to include all of the following:

a. assessment of the potential contribution of the research to the organisation, client and research team
b. identification of any potential spin-offs
c. identification of any related areas requiring research

1.14 record and communicate areas of research to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. specific company document
e. other appropriate media

Learning outcome
The learner will: 2. understand how to identify and define areas of engineering research
Assessment criteria
The learner can: 2.1 explain where to obtain information on problems and issues which could impact on engineering 2.2 explain the potential engineering problems and issues that could require research 2.3 explain how to access relevant information for the research 2.4 explain how to obtain technical data through information technology 2.5 explain how to interpret and evaluate the results of research that has been carried out 2.6 explain the importance of clearly defining the research problem 2.7 explain who needs to be informed about the research problem and its progress 2.8 explain other people who could benefit from the research 2.9 explain how to communicate research information to the appropriate audience 2.10 explain whom to consult on the feasibility and desirability of the research 2.11 explain how to gain approval for the research activity 2.12 explain the typical risks, benefits and constraints associated with undertaking the research, and how to evaluate their impact on the organisation 2.13 explain the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 403 Develop a Research Methodology for Engineering

UAN:	**L/505/0953**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 22 Develop a research methodology for engineering (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to develop a research methodology for engineering, in accordance with approved procedures. The learner will be required to select and produce a methodology that will achieve the research aims and objectives effectively, and they will be required to evaluate the research methodology for any potential constraints or critical requirements. In addition, they will be expected to calculate the resources necessary to carry out the research, and they will be required to communicate the methodology to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of a research methodology, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will be fully conversant with organisational procedures

and systems, and will understand research principles, processes, design and methodology, and data analysis methods. The learner will also understand about research issues specific to their engineering sector or discipline, including patents, copyright and intellectual property issues, and project planning and resource management techniques, in sufficient depth to enable them to carry out their activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. develop a research methodology for engineering
Assessment criteria
The learner can: 1.1 confirm the aims and objectives of the research and identify any critical factors 1.2 obtain and confirm the aims and objectives of the research, from within one of the following areas: a. designs b. organisational requirements c. materials d. technology e. other specific area 1.3 identify all the relevant factors that have an impact on the research methodology 1.4 assess any potential constraints on the research and develop contingency plans to overcome them 1.5 identify any critical factors and constraints that could affect the research, including three of the following: a. cultural acceptability of the activity b. organisational capability c. prestige d. personnel capabilities e. commercial implications f. external contracts g. timescales h. technology requirements i. environmental j. costs

k. availability of resources/facilities
l. safety

1.6 establish the benefits and opportunities of collaborating with others

1.7 select the research methods that can effectively achieve the aims and objectives

1.8 select appropriate research methods, to include four of the following:

a. tests (such as destruction, emission, audio/sound frequency, life expectancy, durability, vibration analysis, simulation)
b. observation
c. qualitative data analysis
d. environmental study
e. quantitative data analysis
f. statistical analysis and sampling
g. interview
h. design of experiments (DoE)
i. case study
j. survey
k. other specific methods

1.9 prioritise and schedule the research activities that are necessary

1.10 prioritise and schedule all of the following into the research methodology:

a. time
b. documentation
c. personnel
d. benchmarks
e. finance
f. outcomes
g. equipment

1.11 calculate the resources and time scales required to implement the methodology

1.12 calculate the resources necessary to implement the research, considering all of the following:

a. personnel
b. hardware and/or software
c. equipment
d. location/site facilities
e. monitoring equipment/system
f. contracts
g. finances

1.13 ensure that the methodology complies with three the following:

a. organisational guidelines and procedures
b. recognised compliance agency/body's standards, directives or codes of practice
c. equipment manufacturer's operating specification/range
d. customer standards and requirements
e. health, safety and environmental requirements
f. British, European or International standards or directives

1.14 evaluate the outcome of their actions, and prepare detailed plans of the methodology, to include all of the following:

a. aims and objectives of the research
b. research method(s)
c. research prioritised schedule
d. resources required and timescales
e. details of contingency plans for overcoming potential constraints
f. assessment of the benefits and opportunities of collaborating with others
g. any factors that have an impact on the research methodology

1.15 produce detailed plans of the research and record them in the appropriate information systems

1.16 record and communicate the research methodology to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to develop a research methodology for engineering
Assessment criteria
The learner can: 2.1 explain how to obtain and confirm the aims and objectives of the research 2.2 explain the different types of area in which research can be undertaken by their organisation 2.3 explain the types of factors that could have a critical effect on the methodology 2.4 explain the types of constraint that could affect the research 2.5 explain how to obtain and interpret information on regulations, directives and guidelines 2.6 explain the regulations, directives and guidelines that could affect the research 2.7 explain the regulations, directives and guidelines that could affect the research 2.8 explain the advantages and disadvantages of collaborating with other organisations and people 2.9 explain the various research methods that could be used, and where to obtain any specialist knowledge or expertise necessary for their application 2.10 explain the statistical analysis techniques used on processes or data 2.11 explain how to decide which are the most effective research methods 2.12 explain how to determine the timescales required for the research 2.13 explain how to prioritise and schedule research activities

2.14	explain how to present research plans
2.15	explain how to obtain information on resources
2.16	explain how to assess the resources that are necessary
2.17	explain how to assess the availability of resources
2.18	explain the appropriate format for presenting the research methodology
2.19	explain the company information systems for recording information
2.20	explain the importance of using the company information systems
2.21	explain the extent of their own authority, and to whom they should report if they have problems that they cannot resolve.

Unit 404 Propose and Specify Engineering Research

UAN:	**R/505/0954**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 23 Propose and specify engineering research (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to propose and specify engineering research, in accordance with approved procedures. The learner will be required to present their research proposals to the appropriate people, and to monitor the progress of the proposal through the organisational approval process. The learner's responsibilities will require them to comply with organisational policy and procedures for proposing and specifying research activities, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes that relate to the area of research. The learner will be fully conversant with organisational procedures and systems, and they will understand the research principles, processes, design, methodology and issues that are specific to their engineering sector or discipline. The learner's underpinning knowledge will also include methods for resource management,

risk analysis and risk assessment, and will be sufficient to enable them to carry out their activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. propose and specify engineering research
Assessment criteria
The learner can: 1.1 comply with organisational procedures for approving research into engineering products or processes 1.2 take into account three of the following when preparing the research proposal: a. British, European or International standards, directives or codes of practice b. recognised compliance agency/body standards, directives or codes of practice c. organisational guidelines and procedures d. equipment manufactures operating specification/range e. customer standards and requirements f. health, safety and environmental requirements g. other (to be specified) 1.3 ensure that the proposed research conforms to company procedures, and covers all of the following: a. aims and objectives or the research b. research methodology c. prioritised schedule d. resources required and timescales e. benefits and risks f. any factors that have an impact on the research methodology 1.4 present clearly the aims and objectives of the research 1.5 present clearly the methodology required to undertake the research 1.6 record and communicate research proposals to the appropriate people, using: a. a verbal report plus one from the following: b. demonstration c. computer generated report d. computer-based presentation e. simulation or display

f. other appropriate media

1.7 specify the resources and timescales required to achieve the research

1.8 specify the timescales required, together with the necessary resources, including four of the following:

a. materials
b. facilities
c. personnel
d. hardware and/or software
e. equipment
f. location/site facilities
g. monitoring equipment/systems
h. contracts
i. finances

1.9 identify the overall benefits and risks of the research

1.10 identify the sources of funding that might be available

1.11 respond positively to any issues relating to the research proposal

1.12 monitor the progress of the proposal and obtain the results of any decision

1.13 monitor the progress of the research proposal, using one of the following:

a. company procedure for research proposals
b. informal discussion
c. computer tracking

Learning outcome
The learner will: 2. understand how to propose and specify engineering research
Assessment criteria
The learner can: 2.1 explain the specific health, safety and environmental issues that relate to the proposed areas of research 2.2 explain the types of engineering product, process or activity that may require research 2.3 explain where to obtain information for the research from within the organisation 2.4 explain the company policies and procedures that should be considered when preparing a research proposal 2.5 explain the approval mechanisms for research proposals 2.6 explain how to present research proposals, and the most appropriate method to use 2.7 explain the types of information and the level of detail that should be included in research proposals 2.8 explain the types of issue that can emerge during the assessment of research proposals 2.9 explain how to identify potential benefits and risks of the research 2.10 explain the importance of responding to the concerns of others 2.11 explain the amount of time to allow for research proposals to be approved 2.12 explain how to monitor the progress of research proposals 2.13 explain how to obtain information on resources 2.14 explain the resources that are necessary 2.15 explain how to assess the availability and suitability of resources 2.16 explain the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 405 Undertake Engineering Research

UAN:	**L/505/0936**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 06: Undertake Engineering Research (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to undertake research of engineering products or processes, in accordance with approved procedures. The learner will be required to carry out specific research, in accordance with established research principles. In addition, they will be required to monitor, analyse and disseminate the research results to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for carrying out successful research, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes, and they will also be fully conversant with organisational procedures and systems. They will understand engineering research principles and process, data analysis methods, patent, copyright and intellectual property issues, project planning and research design methodology, in sufficient depth to enable them to carry

out the research activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. undertake engineering research
Assessment criteria
The learner can: 1.1 apply the research methods into the engineering products or processes according to established research principles 1.2 carry out all of the following activities whilst undertaking the engineering research: a. obtain the aims and objectives from the research proposal b. ensure that all facilities and resources are available c. carry out and monitor the research activities d. record the results of the research, using the appropriate formats e. resolve or recommend appropriate actions to problems, as they occur f. disseminate information on the research activities to the appropriate people 1.3 carry out the research, taking into account all of the following: a. aims and objectives b. potential benefits and risks c. methodology d. design constraints e. resource requirements f. schedule g. budget available h. legislative considerations i. risk analysis j. timescales 1.4 implement the research using the necessary resources, including three of the following: a. materials b. manpower c. equipment d. monitoring equipment/system e. finances f. facilities g. hardware and/or software

h. location/site facilities
i. contracts

1.5 ensure that the correct amount of accurate data is collected as specified in the research methodology

1.6 ensure that the research results are recorded and collated accurately in the appropriate formats

1.7 ensure that the research results are analysed using valid methods

1.8 monitor and record the research process, using two of the following methods:

a. audio and/or video recording
b. sampling
c. manual data collection
d. comparative analysis
e. observation
f. computer-aided data collection
g. mechanical or electronic sensing

1.9 monitor the progress of the research against plans and budgets

1.10 identify any problems with the research as soon as practicable and determine the appropriate actions to take

1.11 disseminate relevant information on the research to the appropriate people according to agreed procedures

1.12 record and communicate details of the research to the appropriate people, using:

a. a verbal report
b. plus one from the following:
c. electronic mail
d. computer-based presentation
e. computer generated report
f. specific company form
g. other appropriate media

1.13 ensure that the research methodology complies with three of the following:

a. organisational guidelines and codes of practice
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards
e. customer standards and requirements
f. British, European or International standards or directives

Learning outcome
The learner will: 2. understand how to undertake engineering research
Assessment criteria
The learner can: 2.1 explain the specific health and safety issues that relate to the areas being researched 2.2 explain how to obtain the research proposal from company systems/records 2.3 explain the research methods that should be used 2.4 explain how to select the most appropriate research method 2.5 explain how to monitor and record the results of the research 2.6 explain the amount and types of data that should be collected for different types of research 2.7 explain the formats that should be used for recording data 2.8 explain the methods available for analysing the results of the research 2.9 explain how to select the most appropriate method(s) for analysing the research data 2.10 explain how to obtain details of the plans and budgets available for the research 2.11 explain how to obtain the resources specified in the research proposal 2.12 explain the types of problem that could occur during the research 2.13 explain the actions that should be taken to deal with different types of problem 2.14 explain who requires information on the research, and the procedures for informing them 2.15 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 406 Evaluate the Results of Engineering Research

UAN:	**Y/505/0955**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 24 Evaluate the results of engineering research (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to evaluate research results, in accordance with approved procedures. The learner will be required to plan the most appropriate way to carry out the evaluation, to establish the criteria against which the evaluation will take place, and to assess the research results against these criteria. The learner will also be required to present their results and recommendations to the relevant people, in the appropriate format. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful evaluation of research, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes, and they will be fully conversant with organisational procedures and systems. The learner will understand data analysis and evaluation methods, patent, copyright and intellectual property issues, in sufficient depth to enable them to

carry out their activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. evaluate the results of engineering research
Assessment criteria
The learner can: 1.1 plan the most appropriate way for evaluating the research 1.2 carry out all of the following activities when evaluating research results: a. establish the evaluation criteria as the basis for the evaluation b. plan the most appropriate evaluation process c. collect information from appropriate sources for inclusion in the evaluation process d. implement the evaluation e. present the results of the evaluation, together with their recommendations 1.3 establish clear and precise criteria for evaluating the success of the research 1.4 establish the criteria for evaluation of the research methodology, to include two of the following: a. test results (such as life expectancy, strength, durability, emission values, audio/sound frequency, statistical results) b. performance c. quality d. costs e. safety f. effects g. environmental/sustainability h. dimensional outcomes i. process outcomes 1.5 obtain accurate information on the research from all valid sources 1.6 obtain the results of the research process using two of the following: a. audio or video recording b. observation c. sampling d. computer-aided data collection e. manual data collection f. mechanical or electronic sensing

g. comparative analysis

1.7 verify the research results by using the most appropriate methods

1.8 assess the research against the evaluation criteria

1.9 evaluate the results of the research, using all of the following:

a. verification of the results
b. assessment against the evaluation criteria
c. records of strengths and weaknesses of the research
d. assessment of the impact of the research on the activities of the organisation
e. any deviations from health, safety and environmental requirements

1.10 highlight the strengths and weaknesses of the research

1.11 identify the impact of the research results on the activities of the organisation

1.12 record and communicate the results of the evaluation to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer-based presentation
d. computer generated report
e. specific company document
f. other appropriate media

1.13 present the results of the evaluation to the appropriate people according to agreed procedures

1.14 recommend future action that could be taken as a result of the evaluation

Learning outcome
The learner will: 2. understand how to evaluate the results of engineering research
Assessment criteria
The learner can: 2.1 explain how to obtain the results of the research from the company information systems 2.2 explain the methods that are available for evaluating research 2.3 explain the types of research undertaken by their organisation 2.4 explain the evaluation criteria that could be used for different types of research 2.5 explain the methods that could be used for obtaining information on the research 2.6 explain the sources of information that can be used in the research 2.7 explain who should be involved in the evaluation process 2.8 explain the methods that could be used for assessing and verifying different types of result 2.9 explain the type of impact that the evaluation could have on the organisation 2.10 explain the regulations, directives and guidelines which could impact on the results of the evaluation, and where to obtain information on them 2.11 explain who requires information on evaluations, and the procedures for informing them 2.12 explain the types of recommendation that could emerge from evaluations 2.13 explain how to present recommendations 2.14 explain the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 407 Identify Engineering Design Requirements of Clients

UAN:	**F/505/0934**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 04: Identify engineering design requirements of clients (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to establish design requirements for clients, in accordance with approved procedures. The learner will be required to consult with the client in order to obtain details of their requirements, and to present the results of such consultation to the relevant people, in the appropriate way. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful identification of design requirements, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to identifying engineering design requirements. They will understand the client consulting process, and its application, and will know about general and design-specific engineering principles and processes, in adequate depth to provide a sound basis for carrying out the activities to the required standard. They will have a good knowledge

of their organisation's procedures and systems, and will be able to identify patents, copyright and intellectual property issues. They will also be able to identify and apply appropriate specifications, details and formats to the client proposal.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. identify engineering design requirements of clients
Assessment criteria
The learner can: 1.1 establish who is the client for the engineering products or processes 1.2 establish the client from one of the following: a. external – existing client b. external – potential client c. internal – existing organisational requirement d. internal – new organisational opportunity 1.3 obtain accurate information on the requirements of the client 1.4 agree with the client a product or process to be designed, from one of the following areas or activities: a. research b. design c. production d. installation e. manufacturing f. maintenance g. engineering operations h. commissioning i. configuration j. decommissioning 1.5 confirm the client's objectives for the engineering products or processes 1.6 obtain accurate information to establish the design objectives, including six of the following: a. function b. life cycle c. technologies d. performance/capability e. monitoring/servicing/maintenance frequency f. aesthetics

g. materials
h. resources
i. delivery schedule
j. usability
k. interfacing
l. environmental/sustainability
m. branding
n. safety
o. on going support
p. budget
q. volume
r. timing
s. other (specify)

1.7 ensure that engineering design requirements comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.8 identify any unique or specific features that need particular consideration

1.9 determine the feasibility of achieving the client's requirements

1.10 confirm the requirements and other relevant issues with the client

1.11 brief the client to contain six of the following:
a. confirmation of objectives
b. draft design concepts
c. supporting calculations and data
d. high level functionality
e. feasibility of achieving requirements
f. description of proposed implementation (including any special features)
g. detail of specific issues for customer consideration (such as product safety, health and safety, impending regulation changes, emerging technologies)
h. project review process
i. product life cycle requirements
j. client on going support

1.12 record all relevant information in the appropriate information systems for future use

1.13 record and communicate requirements to the appropriate people, using:
a. a verbal report
plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to identify engineering design requirements of clients
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental issues relating to the design of engineering products and processes 2.2 explain how to obtain and interpret legislative and regulatory documentation 2.3 explain the clients that they normally work with and how they fit into the supply chain 2.4 explain how to obtain information from a client, and how to assess whether it is accurate 2.5 explain whom they should deal with in the client's organisation 2.6 explain the procedures for contacting the client's organisation 2.7 explain the types of information required for establishing design requirements 2.8 explain the extent and limit of their own organisation's capabilities for producing various designs 2.9 explain the types of design feature that should be considered unique or specific, and why it is important to give these particular consideration 2.10 explain the factors that affect the feasibility of achieving a client's requirements 2.11 explain how to assess the feasibility of achieving the client's requirements 2.12 explain how to prepare a brief confirming the requirements of the client, and why it is important to do so 2.13 explain the various ways of presenting the brief to the client, and the importance of selecting the most appropriate method of presentation 2.14 explain the organisational process or procedure for recording the design requirements 2.15 explain the importance of using company information systems for recording design requirements 2.16 explain the extent of their own responsibility, and their level of authority when dealing with clients 2.17 explain whom they should report to if they have problems that they cannot resolve

Unit 408 Establish an Engineering Design Brief

UAN:	**Y/505/0938**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 07: Establish an engineering design brief (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to establish a design brief for engineering products or processes, in accordance with approved procedures. The learner will be required to gather information from a number of sources to develop the design brief, whilst establishing the application, function and constraints. They will also be required to discuss and communicate the proposals with the client and all other relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful production of the design brief, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems. They will understand engineering design principles, patent, copyright and intellectual property issues, and will know about project planning and resource management

techniques, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. establish an engineering design brief
Assessment criteria
The learner can: 1.1 obtain the correct details of the specification for the engineering product or process 1.2 carry out all of the following activities to establish the design brief: a. identify with the client the reasons or application for the design, and establish any constraints which may affect it b. review the critical operational/functional requirements and quality criteria of the design c. clarify with relevant people any aspects of the design that are ambiguous d. produce the proposed design brief, and discuss any changes needed to suit the operational/functional requirements with the relevant people e. ensure that the design brief meets relevant regulations, directives and guidelines f. record the design brief in the appropriate information system and communicate it to the relevant people 1.3 obtain the design requirements from one of the following types of client: a. external – existing client b. external – potential client c. internal – existing organisational requirement d. internal – new organisational opportunity 1.4 establish information for the development of the design brief from two of the following sources: a. existing designs b. research c. tests or trials d. client e. suppliers f. general or specialised media g. specialists/experts h. engineering department i. user groups

1.5 identify clearly any design constraints

1.6 establish the design brief constraints, considering four of the following:

- a. customer acceptability
- b. delivery schedule
- c. capacity
- d. capability
- e. departmental
- f. available technologies
- g. legal
- h. international/national standards or directives
- i. copyright
- j. environmental/sustainability
- k. logistical
- l. financial
- m. safety
- n. commercial/branding

1.7 incorporate all necessary details into the design brief

1.8 incorporate specifications for three of the following in the design brief:

- a. manufacturing requirements
- b. aesthetics
- c. characteristics
- d. fit, form or function
- e. materials
- f. performance/capability
- g. costs
- h. life cycles
- i. monitoring/servicing/maintenance requirements
- j. timescales
- k. inspection/testing
- l. technology
- m. components/systems

1.9 produce a design brief that effectively encapsulates the requirements of the client

1.10 ensure that the design brief complies with all relevant regulations, directives and guidelines

1.11 clarify and agree the design brief with the client

1.12 confirm that all participants in the design process are aware of the design brief

1.13 record the design brief in the appropriate information systems

1.14 record and communicate design briefs to the appropriate people, using:

- a. a verbal report

  plus one from the following:
- b. electronic mail
- c. computer generated report
- d. computer-based presentation
- e. specific company document
- f. other appropriate media

1.15 ensure that the design briefs comply with three of the following:

a. organisational guidelines and codes of practice
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards
e. customer standards and requirements
f. British, European or International standards or directives

Learning outcome
The learner will: 2. understand how to establish an engineering design brief
Assessment criteria
The learner can: 2.1 explain the specific health, safety and environmental requirements that apply to the product or process to be designed 2.2 explain how to obtain details of the specification of the product or process to be designed 2.3 explain the types of design constraint that should be considered 2.4 explain the different types of design brief that could be required 2.5 explain the types of information and level of detail that should be included in a design brief 2.6 explain the regulations, directives and guidelines that are relevant 2.7 explain how to obtain information on regulations, directives and guidelines 2.8 explain when a client should be consulted on a design brief 2.9 explain who should be informed and consulted on the various aspects of a design brief 2.10 explain the company systems for recording design information 2.11 explain the importance of using the company information systems 2.12 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 409 Develop a Strategy for the Engineering Design Process

UAN:	**D/505/0956**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 25 Develop a strategy for the engineering design process (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to develop a strategy for the engineering design process, in accordance with approved procedures. The learner will be required to identify the design activities that need to be undertaken, to allocate responsibilities and resources to each activity, and to prioritise the completion of the design in line with agreed deadlines. The learner will also be required to observe procedures for disseminating design information, and to develop a design strategy that is agreed will all the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of the design strategy, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will be fully conversant with organisational procedures

and systems, and they will also know about resource management, the design process, and patent, copyright and intellectual property issues, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace..

Learning outcome
The learner will: 1. develop a strategy for the engineering design process
Assessment criteria
The learner can: 1.1 carry out all of the following activities in developing a design strategy: a. establish a means of storing the design documentation and version control (configuration management) b. identify the activities that make up the design process c. establish the responsibility for each activity d. identify the resources required e. identify potential critical problems and generate effective contingency plans accordingly f. communicate information to the appropriate people, and to the quality management system g. develop a schedule for the design process h. ensure that the strategy takes into account regulations, directives and guidelines i. agree the schedule with the appropriate people 1.2 identify the design activities that need to be undertaken 1.3 establish the activities that will make up the design process, to include all of the following: a. confirmation of requirements b. production and review of detailed design/s c. review of reference materials d. development of models (such as software, physical) e. production and review of high level design/s f. obtaining final approval 1.4 establish the responsibilities for developing specific aspects of the design process 1.5 agree procedures for disseminating information on the designs 1.6 establish the procedures to be used during the design process, for all of the following: a. disseminating information

b. change management
c. obtaining resources
d. configuration management
e. reviewing design/s
f. resource procurement

1.7 identify any potentially critical problems and establish effective contingency plans

1.8 identify and obtain the resources necessary to undertake the design process

1.9 develop strategies that include three of the following resources:

a. equipment
b. personnel
c. facilities
d. customer
e. finance
f. materials
g. software/hardware

1.10 prioritise and schedule the effective completion of the design process to achieve any deadlines

1.11 ensure that the design process complies with all relevant regulations, directives and guidelines

1.12 develop strategies that comply with three of the following:

a. organisational guidelines and procedures
b. recognised compliance agency/body's standards, directives or codes of practice
c. equipment manufacturer's operating specification/range
d. customer standards and requirements
e. British, European or International standards or directives
f. health, safety and environmental requirements

1.13 agree an effective strategy for the design process with all relevant people

1.14 record and communicate strategies to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer-based presentation
d. computer generated report
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to develop a strategy for the engineering design process
Assessment criteria
The learner can: 2.1 explain the organisational procedures and information systems for storing design data and configuration management 2.2 explain the organisational activities required for the design process 2.3 explain the importance of establishing and recording responsibilities 2.4 explain who should have responsibility for developing different parts of a design 2.5 explain the various procedures that can be used in the design process 2.6 explain the factors that should be taken into account for disseminating information 2.7 explain the types of problem that could occur during the design process 2.8 explain why it is important to have contingency plans 2.9 explain what should be included in contingency plans 2.10 explain how to prioritise and schedule design activities 2.11 explain how to obtain information on resources 2.12 explain how to determine what resources are necessary 2.13 explain how to determine the availability of resources 2.14 explain the regulations, directives and guidelines that are relevant 2.15 explain how to obtain and interpret information on regulations, directives and guidelines 2.16 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 410 Create Engineering Designs

UAN:	**D/505/0939**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 08: Create engineering designs (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to create engineering designs, in accordance with approved procedures. The learner will be required to obtain the information from a design brief, and to create a design to meet the design brief objectives. In addition, they will be expected to communicate and report any changes or difficulties to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful creation of designs, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems, and will understand patents, copyright and intellectual property issues. They will be able to present their designs to the client and to other interested people, using appropriate methods and formats. The learner will be fully aware of any health,

safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. create engineering designs
Assessment criteria
The learner can: 1.1 create designs that meet the client's requirements as specified in the design brief for the engineering product or process 1.2 carry out all of the following activities when creating the designs: a. obtain and review existing information with reference to the specified design requirements b. prepare outline ideas for the designs, and agree them with interested parties c. carry out the design process, utilising the appropriate technology d. document all facets of the design activity e. communicate the outcomes of the design process to the appropriate people f. deliver the designs in the appropriate format g. ensure that the design cannot be changed or amended without authorisation 1.3 apply approved engineering concepts, processes, principles to achieve the design brief 1.4 carry out the design process, taking into account all of the following: a. client requirements b. design brief c. design constraints d. legal/copyright considerations e. legislative requirements 1.5 use three of the following to obtain the necessary data to produce the required design: a. drawing brief/request b. specifications c. change order/modification request d. regulations e. manuals f. sample/prototype/model g. calculations h. previous drawings/designs i. sketches j. test/trial data k. modelling data

l. standards reference documents
m. notes from meetings/discussions
n. other (to be specified)

1.6 create a suitable range of designs for the client to consider

1.7 create designs which take into consideration twelve of the following:

a. function
b. financial constraints
c. manufacturing or installation requirements
d. installation or commissioning requirements
e. building redundancy into the design
f. aesthetics
g. performance/capability
h. reliability
i. life cycle of product, system or process
j. compatibility
k. maintenance and repair
l. characteristics
m. appropriate materials
n. corporate branding
o. technology
p. product features
q. availability of resources
r. components to be used
s. any interface requirements
t. future client support
u. timescales
v. diversity/alternatives
w. safety
x. environmental/sustainability factors
y. other (to be specified)

1.8 produce designs which include ten of the following:

a. straight lines
b. symbols and abbreviations
c. hidden detail
d. hatching or shading
e. dimensions
f. curved/contour lines
g. sectional detail
h. surface detail/profiles
i. insertion of standard components(such as mechanical,electrical, electronic or fluid power)
j. angled lines
k. circles or ellipses
l. parts lists
m. technical data and information
n. tolerances
o. test points
p. connection or termination points
q. component coding

r. routing details
s. system interface
t. component, equipment, system or site layout
u. fault diagrams/trees
v. component type, rating or specification
w. other (to be specified)

1.9 obtain suitable advice and guidance to assist in the design work

1.10 present the designs in suitable formats and with sufficient information to allow the client to assess them

1.11 identify any variations from the design brief and provide a suitable rationale for them

1.12 ensure that engineering designs comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.13 ensure that the designs are protected in line with organisational procedures

1.14 deal promptly and effectively with problems within their control and seek help and guidance from the relevant people if they have problems that they cannot resolve

1.15 communicate details of the engineering designs to the appropriate people, using:
a. a verbal report
plus one from the following:
b. computer generated report
c. computer-based presentation
d. specific company document
e. other appropriate media

Learning outcome
The learner will: 2. understand how to create engineering designs
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when working with computer systems (to include safety guidance relating to the use of visual display unit (vdu) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (rsi); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections) 2.2 explain the methods and procedures used to minimise the chances of infecting a computer with a virus 2.3 explain the implications if the computer they are using does become infected with a virus and who to contact if it does occur 2.4 explain the relevant sources and methods for obtaining any

	required technical information relevant to the design being produced
2.5	explain how to identify of the correct design software/package and the factors that must be considered
2.6	explain the regulations, standards, directives and codes of practice that are relevant, and any implications they have on the design
2.7	explain how to obtain information on regulations, standards directives and codes of practice
2.8	explain the national, international and organisational standards and conventions that are used for the design
2.9	explain the underlying engineering or manufacturing principles and concepts required to produce fit for purpose designs
2.10	explain the functionality of the design including any interrelationships required with other components/products/systems or technologies
2.11	explain how and where to obtain the design brief/specification
2.12	explain the different types of design brief that could be required
2.13	explain how to address any necessary variations from the design brief
2.14	explain the types and level of detail that should be included in a design
2.15	explain the methods for achieving different types of design
2.16	explain the design formats that are most suitable to meet the client's needs
2.17	explain the number of different designs that are necessary to provide a client with options
2.18	explain the sources of advice and guidance on designs
2.19	explain how to present designs to the client
2.20	explain the potential risks to a design, and how can it be protected
2.21	explain the need for effective document and data control and the implications if these are not applied
2.22	explain the need to create backup copies, and to file tem in a separate and safe location
2.23	explain the procedures used for making changes or amendments to the design
2.24	explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 411 Evaluate Engineering Designs

UAN:	**R/505/0940**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 09: Evaluate engineering designs (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to evaluate engineering designs, in accordance with approved procedures. The learner will be required to plan the most effective way to evaluate the design, to establish the criteria for evaluation, and to obtain relevant information from the appropriate sources. They will then present the results of the evaluation, together with any recommendations, to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for carrying out the evaluation process, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems, and with the methods of evaluation. They will also be able to use various presentation methods for conveying results and recommendations. They will be fully aware of any health, safety

and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. evaluate engineering designs
Assessment criteria
The learner can: 1.1 plan the most appropriate way for evaluating the design of the engineering product or process 1.2 establish clear and precise criteria for evaluating the designs 1.3 establish the criteria for evaluating the design, considering twelve of the following: a. function b. financial constraints c. manufacturing or installation requirements d. installation or commissioning requirements e. building redundancy into the design f. appropriate materials g. technology h. aesthetics i. performance/capability j. reliability k. life cycle of product, system or process l. servicing, maintenance or repair m. product features n. availability of resources o. characteristics p. corporate branding q. components or systems to be used r. functional requirements s. any interface requirements t. future client support u. timescales v. diversity/alternatives w. safety x. environmental and sustainability factors y. other (to be specified) 1.4 obtain accurate information on the designs from all valid sources 1.5 obtain information to assist the evaluation, from the design brief to include two of the following: a. the design options created b. design presentations c. any previous modelling/mock ups or simulations d. design documentation

e. suppliers
f. consultant/research data
g. equipment manufacturers
h. general or specialised media
i. technical specialists
j. colleagues
k. operational staff/users
l. the client/customer

1.6 carry out all of the following activities when evaluating the design:
a. plan the most appropriate way to evaluate the design
b. obtain clear criteria on which to base the evaluation
c. obtain the necessary information from the appropriate sources
d. evaluate the design against the established criteria, using appropriate evaluation methods
e. make recommendations on various design options, and communicate the results of the evaluation to the appropriate people

1.7 evaluate engineering designs, using:
a. analysis of the design documentation
b. plus one of the following:
c. simulation
d. small-scale production
e. pilot trial/test
f. model/mock-up
g. prototype assessment
h. software simulation/modelling
i. consultation/market research

1.8 evaluate all of the following in engineering designs:
a. performance against design criteria
b. how effectively they meet the design brief
c. advantages/disadvantages
d. options for improvement
e. conformity with organisational/ industry standards, directives or codes of practice
f. conformity with relevant health, safety and environmental standards

1.9 verify the designs by using the most appropriate methods

1.10 assess the designs against the evaluation criteria

1.11 highlight the strengths and weaknesses of the designs

1.12 identify the designs that are the most effective at meeting the client's requirements

1.13 present the results of the evaluation to the appropriate people according to agreed procedures

1.14 present the results of the evaluation, and their recommendations, to two of the following:
a. the design team
b. the client
c. colleagues
d. other stakeholders

1.15 recommend options for the designs

Learning outcome
The learner will: 2. understand how to evaluate engineering designs
Assessment criteria
The learner can: 2.1 explain the various methods that are used for evaluating designs 2.2 explain how to select the most appropriate evaluation method 2.3 explain the evaluation criteria that could be used for different types of design 2.4 explain how to obtain the different types of design information 2.5 explain where to obtain the design information 2.6 explain who should be involved in the evaluation process 2.7 explain how to determine what additional resources may be required for the evaluation process 2.8 explain how to obtain additional resources 2.9 explain the methods that could be used for verifying different types of result 2.10 explain the type of impact the evaluation could have on the organisation 2.11 explain who requires information on evaluations, and the procedures for informing them 2.12 explain the types of recommendation that could emerge from evaluations 2.13 explain how to present recommendations, and the various ways in which this can be achieved 2.14 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 412 Contribute to a team feasibility review of a new product design

UAN:	**Y/505/1006**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 005 - Contribute to a team feasibility review of a new product design.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to contribute to a team feasibility review of a new product being developed and introduced for the first time. The learner will be required to evaluate the design with other members of the new product development and introduction (NPDI) team in the context of their area of responsibility. The learner will also be required to identify and recommend improvements to the design from the perspective of their area of responsibility. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring, through their technical support of the NPDI team, the successful review of the new product. The learner will also report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or with the team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design principles and processes.

The learner will be fully conversant with organisational procedures and systems for reviewing new products, in the context of their own expertise and area of responsibility.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. contribute to a team feasibility review of a new product design
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 carry out all of the following activities in the product feasibility review: a. identify important characteristics of the design b. provide technical evaluation and recommended strategies c. identify potential strengths, weakness and opportunities for the new product, in the context of their area of responsibility d. communicate information to the appropriate people and to the quality management system 1.3 establish the criteria and procedures for feasibility review of the design, including six of the following: a. functionality b. performance/specification c. aesthetics d. materials e. cost f. regulatory requirements g. weight h. recycling i. manufacturability j. durability k. interfacing l. safety 1.4 evaluate the team review meeting agenda and identify actions 1.5 prepare data and information for the team review of the new product 1.6 evaluate the design specification in the context of their area of responsibility 1.7 carry out the product review activity, to include all of the following: a. establish comparisons between the new product and existing

products/processes
b. review comparison data and information systems
c. identify new technologies that are being included in the new product
d. identify effective methods and techniques for meeting the design requirements
e. generate ideas for improved product performance

1.8 contribute technical advice and recommendations to the review process, on two of the following:
a. machining
b. welding
c. assembling
d. casting
e. forming
f. wiring
g. testing/inspection
h. packaging
i. coating/covering
j. electrical components
k. electronic components
l. fabrication
m. joining
n. pressing
o. storing
p. logistics/movement
q. processing operations
r. moulding
s. laying up
t. bonding/gluing
u. heat treatment
v. integrated technologies
w. computer hardware/software
x. new technologies
y. other (specify)

1.9 make recommendations as to where improvements/changes can be made to the design/product

1.10 record the results of the feasibility exercise, according to agreed procedures

1.11 record and communicate the results of the review exercise to the appropriate people using:
a. a verbal report
plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

1.12 execute and communicate agreed actions, following the feasibility exercise, in the agreed timescales

Learning outcome
The learner will: 2. understand how to contribute to a team feasibility review of a new product design
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations/directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the organisational procedures and information systems for storing product review data 2.4 explain the organisational activities required for the NPDI team's product review process 2.5 explain the importance of establishing and recording responsibilities for new product review and analysis process 2.6 explain who should have responsibility for the different parts of the review process 2.7 explain the various procedures that can be used in the product review process 2.8 explain the principles and techniques used in a structured new product review 2.9 explain the factors to be taken into account for disseminating information before and after a review process 2.10 explain the types of problem that could occur during the team review process 2.11 explain the methods and techniques used to evaluate new products 2.12 explain how to use decision making and creativity techniques (such as brainstorming) to generate ideas for improvement 2.13 explain how to prioritise and rank improvement ideas 2.14 explain why it is important to have new product review exercises 2.15 explain what should be included in plans for team reviews of new products 2.16 explain how to prioritise and schedule review activities 2.17 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 413 Control the New Product Design Change Process

UAN:	**H/505/1008**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 014 - Control the new product design change process.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to control the design change process. The learner will be required to follow a systematic approach to design change analysis and control. The learner will also be required to make changes in agreement with all the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of the design strategy, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific new product design principles and processes. The learner will be fully conversant with the methods and techniques used to evaluate design changes, and the data and information that supports change requests. The learner will be fully aware of any health,

safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. control the new product design change process
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 obtain correct and accurate details about the design change needed 1.3 establish why the change is necessary, using the appropriate supporting data and information 1.4 establish the need for the design change from two of the following sources: a. existing designs b. research c. tests or trials d. client e. suppliers f. manufacturing and/or assembly department g. specialists/experts h. engineering department i. quality assurance department 1.5 establish design change requirements, and analyse data for six of the following criteria: a. functionality b. performance c. aesthetics d. materials e. delivery f. regulatory requirements g. weight h. recycling i. manufacturability j. durability k. interfacing l. environmental impact 1.6 use a structured approach to implementing the design change 1.7 produce the conceptual design options for manufacture and/or assembly 1.8 identify the designs that most effectively meet the change requirements 1.9 justify change against all of the following criteria:

a. quality
b. cost
c. delivery

1.10 evaluate design change options, using three of the following:
a. strengths, weaknesses, opportunities and threats (SWOT) analysis
b. force field analysis
c. critical success factor/process matrix
d. process failure mode and effects analysis (PFMEA)
e. weighted selection
f. tree diagram
g. attribute analysis
h. fishbone diagram
i. relationship diagram
j. paired comparison
k. mind map
l. technology/state-of-the-art analysis
m. other (specify)

1.11 ensure that the build plan complies with relevant regulations, directives, standards and guidelines, from one of the following:
a. international
b. national
c. manufacturer specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.12 generate the appropriate documentation to implement the change

1.13 establish and implement the appropriate validation process, and obtain sign-off from the relevant people for the change

1.14 record and communicate the results of the change process to the appropriate people using:
a. a verbal report
plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

1.15 record and communicate the design change, using the appropriate information system

Learning outcome
The learner will: 2. understand how to control the new product design change process
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the specific health and safety requirements that apply to the design being changed 2.4 explain how to obtain details of the specification of the design being changed 2.5 explain the types of design change options that should be considered 2.6 explain the different types of design change that could be required 2.7 explain the types of information and level of detail that should be included in a design change document 2.8 explain how to use a systematic approach to design change 2.9 explain how to analyse the design change data and information 2.10 explain the regulations and guidelines that are relevant 2.11 explain how to obtain information on regulations and guidelines 2.12 explain when a client should be consulted on a design change 2.13 explain who should be informed and consulted on the various aspects of a design change 2.14 explain the company systems for recording design change information 2.15 explain the importance of using the company information systems 2.16 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 414 Plan and control new product design benchmarking activities

UAN:	**K/505/1009**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 015 - Plan and control new product design benchmarking activities.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to use a structured approach for comparing products of their organisation against the best available from other organisations. The learner will be required to identify gaps in current product performance. The learner will also be required to generate ideas and strategies for improvement that are agreed with all the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful implementation of the benchmarking activity, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their own actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific new product design principles and processes. The learner will be fully conversant with analytical principles and techniques used in benchmarking, such as strengths, weaknesses, opportunities,

threats (SWOT) analysis, attribute analysis, fishbone diagram and weighted selection.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. plan and control new product design benchmarking activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 obtain all customer requirements and the design specification for the new product 1.3 develop a benchmarking strategy for the new product/design 1.4 establish the criteria and procedures for benchmarking the design, including all of the following: a. functionality b. performance/specification c. aesthetics d. materials e. cost f. regulatory requirements g. weight h. recycling/sustainability i. manufacturability j. obtaining parts k. literature reviews l. customer needs m. methods and techniques n. durability o. interfacing p. safety 1.5 implement the benchmarking activity, using appropriate methods and techniques to include all of the following: a. establish the existing key competitor designs for the new product b. establish benchmarking criteria from customer requirements and design specification c. obtain all available information on the competitor designs, and assess them against the benchmarking criteria

d. identify gaps in current product performance
e. establish current state of the art for each identified benchmarking criteria
f. identify the designs that are the most effective at meeting the customer's requirements

1.6 collect and analyse the data gained from the benchmarking activity, using approved techniques

to include three of the following:

a. strengths, weaknesses, opportunities and threats (SWOT) analysis
b. force field analysis
c. critical success factor/process matrix
d. design failure mode and effects analysis
e. weighted selection
f. tree diagram
g. attribute analysis
h. fishbone diagram
i. relationship diagram
j. paired comparison
k. mind map
l. technology/state-of-the-art analysis
m. other (specify)

1.7 make recommendations as to where improvements can be made to the design/product

1.8 communicate the results of the benchmarking exercise and record it in the relevant company information systems by a :

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

1.9 present and record the results of the benchmarking exercise to the appropriate people, according to agreed procedures

Learning outcome
The learner will: 2. understand how to plan and control new product design benchmarking activities
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations/directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme

2.3	explain the organisational procedures and information systems for storing benchmarking data
2.4	explain the organisational activities required for the benchmarking process
2.5	explain the importance of establishing and recording responsibilities for benchmarking data collection
2.6	explain who should have responsibility for developing different parts of the benchmarking process
2.7	explain the various procedures that can be used in the benchmarking process
2.8	explain the principles and techniques used in structured product comparison
2.9	explain the factors that should be taken into account for disseminating information
2.10	explain the types of problem that could occur during the benchmarking process
2.11	explain the methods and techniques used to evaluate competitor products
2.12	explain how to group critical success factors into categories (such as using fishbone diagrams or tree diagrams)
2.13	explain how to identify gaps in current product performance
2.14	explain what constitutes value adding and non-value adding activities
2.15	explain how to identify what a customer requires from a product
2.16	explain how to complete a risk assessment for using alternative new/state-of-the-art technology
2.17	explain how to use decision making and creativity techniques (such as brainstorming) to generate ideas for improvement
2.18	explain how to prioritise and rank improvement ideas
2.19	explain why it is important to have benchmarking exercises
2.20	explain what should be included in benchmarking plans
2.21	explain how to prioritise and schedule benchmarking activities
2.22	explain how to obtain information on key competitor products
2.23	explain how to determine what resources are necessary for the benchmarking exercise (such as competitor products)
2.24	explain the regulations and guidelines that are relevant
2.25	explain how to obtain and interpret information on regulations, directives and guidelines
2.26	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 415 Establish new product development and introduction brief

UAN:	**H/505/1011**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 016 - Establish new product development and introduction brief.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to establish new product development and introduction requirements for clients, in accordance with approved procedures. The learner will be required to consult with the client in order to obtain details and to present a design brief for new products or processes, in accordance with approved procedures. The learner will be required to gather information from a number of sources to develop the design brief, establishing application, function and constraints. The learner will also be required to discuss and communicate the proposals with the client and all other relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful production of the design brief, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's knowledge will provide a good

understanding of general and discipline-specific new product development principles and processes. The learner will be fully conversant with organisational procedures and systems. The learner will understand design principles and patent, copyright and intellectual property issues, and will know about project planning and resource management techniques, in sufficient depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. establish new product development and introduction brief
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 carry out all of the following activities to establish the NPDI brief: a. identify with the client the reasons or application for the new product design, and establish any constraints which may affect it b. review the critical operational/functional requirements and quality criteria of the NPDI c. clarify with relevant people any aspects of the design that are ambiguous d. produce the proposed NPDI brief, and discuss any changes needed to suit the operational/functional requirements with the relevant people e. ensure that the NPDI brief meets relevant regulations and guidelines f. agree the NPDI brief with the client for the design g. record the NPDI brief in the appropriate information system, and communicate it to the relevant people 1.3 establish who is the client for the new product development and introduction (NPDI) brief 1.4 obtain accurate information on the NPDI requirements of the client to include one of the following: a. external – existing client b. external – potential client c. internal – existing organisational requirement d. internal – new organisational opportunity

1.5 establish information for the development of the NPDI brief from two of the following sources:
   a. existing designs
   b. research
   c. tests or trials
   d. client
   e. suppliers
   f. general or specialist media
   g. specialists/experts
   h. engineering department
   i. user groups

1.6 identify any unique or specific features that need particular consideration

1.7 determine the feasibility of achieving the client's requirements

1.8 identify clearly any design constraints

1.9 establish the NPDI brief constraints, considering four of the following:
   a. customer acceptability
   b. time availability
   c. cost of resources
   d. capacity
   e. copyright
   f. departmental
   g. legal
   h. international/national standards
   i. environmental
   j. logistical
   k. safety
   l. commercial/prestige

1.10 obtain accurate information to establish NPDI objectives and specifications for six of the following:
   a. aesthetics
   b. quality characteristics
   c. function
   d. performance
   e. resources
   f. delivery schedule
   g. usability
   h. materials
   i. performance
   j. cost
   k. interfacing
   l. technology
   m. components
   n. durability

1.11 prepare a NPDI brief for the client containing all of the following:
   a. confirmation of objectives
   b. high level functionality
   c. feasibility of achieving requirements
   d. description of proposed implementation (including any special

features)
e. detail of specific issues for consideration (such as product safety, health and safety, impending regulation changes, emerging technology)
f. NPDI project review process

1.12 incorporate all necessary details into the design brief

1.13 produce a NPDI brief that effectively encapsulates the requirements of the client

1.14 ensure that the NPDI brief complies with all relevant regulations and guidelines

to include one of the following:

a. international
b. national
c. manufacturer specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.15 clarify and agree the NPDI brief with the client

1.16 confirm that all participants in the design process are aware of the NPDI brief

1.17 record the NPDI brief in the appropriate information systems and communicate it to appropriate people using:

a. verbal reports

plus one of the following methods:

b. electronic mail
c. computer-based presentation
d. computer-based report
e. specific company form

Learning outcome
The learner will: 2. understand how to establish new product development and introduction brief
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain how to obtain details of the specification of the product or process to be designed 2.4 explain the types of design constraints that should be considered 2.5 explain the different types of existing design brief that could be required 2.6 explain the types of information and level of detail that should be included in a NPDI brief

2.7	explain when a client should be consulted on a NPDI brief
2.8	explain who should be informed and consulted on the various aspects of a NPDI brief
2.9	explain how to obtain and interpret legislation and regulatory documentation
2.10	explain the clients that they normally work with, and how they fit into the supply chain
2.11	explain how to obtain information from a client, and how to assess whether it is accurate
2.12	explain whom they should deal with in a client's organisation
2.13	explain the procedures for contacting the client's organisation
2.14	explain the types of information that is necessary for establishing NPDI requirements
2.15	explain the organisational procedures and information systems for storing NPDI data
2.16	explain the various technologies to be used in the NPDI concepts
2.17	explain the equipment and methods used to produce the NPDI concepts
2.18	explain the extent and limit of their own organisation's capabilities for producing various new product designs
2.19	explain the types of design feature that should be considered unique, and why it is important to give these particular consideration
2.20	explain the factors that should be taken into account for disseminating NPDI information
2.21	explain the types of problem that could occur during the design concept process
2.22	explain the methods and techniques used to evaluate design concepts
2.23	explain why it is important to have or generate a range of design concepts
2.24	explain the hazards associated with the various technologies
2.25	explain how to conduct a risk assessment of the various design concepts, and identify associated contingency plans to minimise their effect
2.26	explain how to determine what resources are necessary for the design concept exercise
2.27	explain how to assess the feasibility of achieving the client's requirements
2.28	explain how to present a NPDI brief to the client, and the importance of selecting the most appropriate method of presentation
2.29	explain how to obtain and interpret relevant information on regulations and guidelines
2.30	explain the organisational process or procedure for recording new product design requirements, and the importance of using this
2.31	explain the extent of their own responsibility and their level of authority when dealing with clients
2.32	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 416 Produce and evaluate conceptual design options for new products

UAN:	**D/505/1010**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 017 - Produce and evaluate conceptual design options for new products.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce and evaluate conceptual design options for new products. The learner will be required to apply a systematic approach to the evaluation process. The learner will also be required to carry out an evaluation of the technologies used, to identify any perceived risks and to produce a contingency plan that is agreed will all the relevant people, to minimise these risks. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of the design strategy, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design principles and processes. The learner will be fully conversant with evaluative methods, such as SWOT analysis and DFMEA.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. produce and evaluate conceptual design options for new products
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations/directives and guidelines 1.2 carry out all of the following activities in producing and evaluating conceptual designs: a. produce the conceptual design options b. identify the criteria to be used to evaluate each of the conceptual designs c. evaluate each conceptual design against the established criteria d. identify the designs that are most effective at meeting the customer's requirements e. identify any risks, and produce a contingency strategy for minimising them 1.3 evaluate design such as concepts for two of the following: a. materials (metals, chemicals, plastics, ceramics, composites) b. electrical components c. software programs d. electronic components e. mechanical components f. integrated technologies g. fabricated/welded h. other (specify) 1.4 apply a systematic approach to the evaluation process 1.5 obtain all customer requirements and the design specification for the new product 1.6 establish all the technologies to be considered as part of the design 1.7 produce conceptual designs using each of the identified technologies 1.8 identify the criteria to be used to evaluate each of the conceptual designs from the customer requirements, and evaluate using at least one of the following: a. strengths, weaknesses, opportunities and threats (SWOT) analysis b. force field analysis c. critical success factor/process matrix

d. design failure mode & effects analysis (DFMEA)
e. weighted selection
f. tree diagram
g. attribute analysis
h. fishbone diagram
i. relationship diagram
j. paired comparison
k. mind map
l. technology/state-of-the-art analysis
m. other (specify)

1.9 evaluate each conceptual design against the established criteria, and identify the designs that are most effective at meeting the customer's requirements

1.10 compare results and design performance from similar design exercises, and identify any lessons learned

1.11 identify any perceived risks, and produce a contingency strategy for minimising them. to include all of the following:
a. embedded technology
b. innovative technology
c. security of supply
d. lack of performance
e. environmental constraints
f. interfacing components/technologies
g. hazardous processes
h. hazardous material
i. hazardous emissions
j. other specific

1.12 record and present the results of the evaluation to the appropriate people, according to agreed procedures

Learning outcome
The learner will: 2. understand how to produce and evaluate conceptual design options for new products
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify manage and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the organisational procedures and information systems for storing conceptual design data 2.4 explain the various technologies to be used in the design concepts 2.5 explain how to apply and use a systematic approach to the evaluation process 2.6 explain the equipment and methods used to produce the design concepts

2.7	explain the factors that should be taken into account for disseminating information
2.8	explain the types of problem that could occur during the design concept process
2.9	explain the methods and techniques used to evaluate design concepts
2.10	explain why it is important to generate a range of design concepts
2.11	explain how to conduct a risk assessment of the various design concepts, and identify associated contingency plans to minimise their effect
2.12	explain how to determine what resources are necessary for the design concept exercise
2.13	explain the hazards associated with the various technologies
2.14	explain how to obtain and interpret relevant information on regulations, directives and guidelines
2.15	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 417 Verify new product designs using a computer model

UAN:	**K/505/1012**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 018 - Verify new product designs using a computer model.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to verify designs using computer models. The learner will be required to set up and operate a computer-aided design (CAD) modelling system to produce models for design verification of products, in accordance with approved practices. The learner will also be expected to work against the appropriate British, European, International and company standards to evaluate designs, in a format that is agreed with all the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of the computer model, within a drawing office or CAD suite. The learner will be required to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their own actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design modelling principles and processes. The learner will be competent with operating principles of the hardware

and software used to generate computer models.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. verify new product designs using a computer model
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 carry out all of the following activities in verifying designs with computer models: a. obtain the documentation and drawings containing design data for the computer model b. plan the methods to be used in constructing and evaluating the design using the computer model c. develop the computer model for the design in the appropriate format and software d. evaluate results from the computer model against the design data, using established procedures 1.3 establish a method for creation of the computer model, using at least one of the following: a. 3D surface modelling for CAM system b. 3D graphical motion/ function modelling 1.4 establish design concepts and mechanism for collecting data from the model, for at least four of the following characteristics: a. geometry b. aesthetics c. materials d. weight e. durability f. interfacing g. performance h. assembly/manufacturability i. other (specify) 1.5 determine and obtain the appropriate resources, including three of the following: a. equipment b. facilities c. finance d. plant e. components

f. materials
g. people
h. services
i. other specific

1.6 obtain the design data to be verified with the computer model

1.7 use the appropriate equipment hardware and software to create the computer model, in the appropriate format

1.8 establish the plan to evaluate the computer model against requirements, including three of the following:

a. timing plan
b. identification of authorisation channels
c. environmental requirements
d. configuring process
e. preparation of the model
f. preparation of the process
g. testing and/or trials
h. handover process

1.9 establish key criteria for verification of the design performance

1.10 run the computer model and evaluate results and design performance against the criteria

1.11 monitor the modelling and verification process to ensure that it meets the design characteristics, and that all of the following are achieved:

a. correct implementation of the agreed plan
b. effective use of resources
c. identification and solving of any problems that occur

1.12 identify any potential risks from the computer modelling exercise

1.13 ensure that the modelling and evaluation process complies with relevant regulations, directives and guidelines, including one of the following:

a. international
b. national
c. manufacturing specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.14 record the outcomes of the evaluation process in the appropriate company information system, and communicate the outcomes to the relevant people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

1.15 present the results of the verification exercise to the appropriate people, according to agreed procedures

1.16 record all relevant information in the appropriate information systems for future use, according to agreed procedures

Learning outcome
The learner will: 2. understand how to verify new product designs using a computer model
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and workstation environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections) 2.4 explain the good housekeeping arrangements (such as cleaning down work surfaces; putting storage devices, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition) 2.5 explain the basic set-up and operation of the modelling system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner) 2.6 explain the correct start-up and shutdown procedures to be used for the computer system 2.7 explain how to access the specific computer modelling software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system 2.8 explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads) 2.9 explain the national, international and organisational standards and conventions that are used for the models 2.10 explain how to set up computer model templates parameters (such as layers of drawings, scale, size, colour set-up, line types, dimensioning system and text styles) 2.11 explain the application and use of computer modelling tools (such as for straight lines, curves and circles; how to create hatching and shading on drawings; producing layers of drawings) 2.12 explain how to access, recognise and use a wide range of standard components and symbol libraries from the cad equipment 2.13 explain the applications of different 3d modelling programmes (such as surface, solid and wire frame) 2.14 explain the display views that can be used on 3d models (such as view co-ordinate geometry and object co-ordinate geometry) 2.15 explain the application and use of drawing tools for surface or solid modelling; how to modify drawings using surface/solid modelling tools or boolean operators; how to add dimensions and text to

model drawings

2.16 explain the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies of computer files and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)

2.17 explain the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings

2.18 explain the sources and methods for obtaining the required technical information relevant to the model being produced (such as limits and fits, contraction allowances, bearing selection, surface finish)

2.19 explain the various technologies to be used in the verification of designs using computers

2.20 explain the equipment and methods used to produce computer models

2.21 explain the factors that should be taken into account for disseminating information

2.22 explain the types of problem that could occur during the design modelling process

2.23 explain the methods and techniques used to verify designs using computer models

2.24 explain why it is important to have models to verify designs

2.25 explain how to conduct a risk assessment of the various designs, and identify associated contingency plans to minimise their effect

2.26 explain how to determine what resources are necessary for the design modelling exercise

2.27 explain the regulations, directives and guidelines that are relevant

2.28 explain the methods and procedures used to minimise the chances of infecting a computer with a virus

2.29 explain the implications if the computer they are using does become infected with a virus and who to contact if it does occur.

2.30 explain how to obtain and interpret information on regulations, directives and guidelines

2.31 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 418 Verify new product designs using a physical model

UAN:	**L/505/1018**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 019 - Verify new product designs using a physical model.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to plan the creation of a physical model and verify its performance against defined design data. The learner will be required to establish the design data against which the model is to be evaluated, determine the most suitable modelling process and arrange for the model to be created. The learner will also be required to plan the evaluation process, obtain all the required data from the physical model, record this data and present their findings to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful verification of the product design, and to report any problems that they cannot personally resolve, or are outside their area of responsibility, to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design principles and processes. The learner will be fully conversant with

physical modelling processes and technologies.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. verify new product designs using a physical model
Assessment criteria
The learner can: 1.1 obtain the design data against which the physical model is to be verified 1.2 carry out all of the following activities in preparation for verifying the conceptual designs: a. obtain all relevant design documentation for the physical model (such as design drawings, specifications, customer brief/requirements) b. determine the resources required to produce the physical model (such as modelling method, materials required, people with the required skills, access to specialised equipment such as wind tunnels) c. plan the methods to be used in constructing and evaluating the physical model d. establish key criteria for verification of the physical model against the design data e. establish methods of collecting the required design data from the physical model f. determine how the results of the verification exercise will be recorded in company systems 1.3 consider the various ways of producing the physical model and establish the most appropriate method. to include one of the following: a. rapid prototyping b. soft tool c. handmade d. machined e. formed f. fabricated g. other specific process 1.4 determine and obtain the appropriate resources, including three of the following: a. equipment b. facilities c. finance

d. plant
e. components
f. materials
g. people
h. services
i. other (specify)

1.5 identify any potential design limits and constraints from the physical modelling exercise

1.6 arrange construction of the physical model

1.7 monitor the modelling process, to ensure that it meets the design characteristic and that all of the following are achieved:
a. correct implementation of the agreed plan
b. effective use of resources
c. the model produced accurately reflects the design data
d. identification and solving of any problems that occur

1.8 collect design data from the physical model using the appropriate equipment, materials and people. to include four of the following:
a. geometry
b. aesthetics
c. materials
d. weight
e. durability
f. interfacing
g. performance
h. assembly/manufacturability
i. aerodynamics
j. safety
k. other (specify)

1.9 establish a plan to evaluate the physical model against requirements, to include three of the following:
a. timing plan
b. identification of authorisation channels
c. environmental requirements
d. configuring process
e. preparation of the model
f. preparation of the process
g. testing and/or trials
h. handover process

1.10 ensure that the modelling and evaluation process complies with relevant regulations and guidelines, including one of the following:
a. international
b. national
c. manufacturing specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.11 evaluate the data taken from the physical model against the design data requirements

1.12 make valid decisions about the design based on the data taken from the physical model

1.13 record and present the results of the verification exercise to the

appropriate people, according to agreed procedures

1.14 record the outcomes of the evaluation process in the appropriate company information system, and communicate the outcomes to the relevant people, using the following:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome

The learner will:

2. understand how to verify new product designs using a physical model

Assessment criteria

The learner can:

2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken

2.2 explain how to identify manage and minimise potential risks to health and safety that could occur during implementation of the NPDI programme

2.3 explain the health, safety and environmental requirements applicable to the modelling process activities, location and process/facility being used

2.4 explain how to obtain design data for the modelling and evaluation process

2.5 explain how to use the design data to determine the most suitable method of producing the physical model

2.6 explain the various technologies that can be used in the creation of physical models, such as rapid prototyping, soft tool, handmade

2.7 explain the benefits, constraints and physical limitations of the various modelling processes

2.8 explain the organisational procedures and information systems for verifying designs using physical models

2.9 explain the equipment and methods used to evaluate the physical model (such as tolerance measurement using a coordinate measuring machine (CMM), aerodynamics using wind tunnels)

2.10 explain how the results of the design verification are to be presented: such as, a printed report, electronically (data or design file), exceptions only, a red/yellow/green light or some other type of go/no-go indicators

2.11 explain the principles to be used for the modelling and evaluation process

2.12 explain the factors that should be taken into account for disseminating information

2.13 explain the types of problem that could occur during the modelling process

2.14	explain the methods and techniques used to evaluate design models
2.15	explain how to determine and obtain the resources necessary for the modelling exercise
2.16	explain the regulations and guidelines that are relevant
2.17	explain the company's systems for recording and communicating information
2.18	explain the hazards associated with the various technologies and how to deal with them
2.19	explain how to obtain and interpret information on regulations and guidelines
2.20	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 419 Produce new product designs for manufacture and assembly

UAN:	**T/505/1045**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 020 - Produce new product designs for manufacture and assembly
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce a build plan for the manufacture and/or assembly of a new product design. The learner will be required to follow a systematic approach to design for manufacture (DFM) and/or design for assembly (DFA) analysis. The learner will also be required to produce a product build plan that is agreed with all the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of the build plan, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design principles and processes. The learner will be fully conversant with the various analytical techniques to identify non-added value activities, listing alternatives, prioritising and ranking using appropriate risk assessment and other evaluative

techniques.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. produce new product designs for manufacture and assembly
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 obtain the correct details for the new product and the available manufacturing and/or assembly process 1.3 review best practice used in the current manufacturing and/or assembly processes. to include three of the following: a. tool access b. packaging c. weight d. toxic materials/substances e. sequencing f. handling g. access h. maintenance i. tolerancing j. contamination k. other (specify) 1.4 identify clearly any design or manufacturing and/or assembly constraints 1.5 collect and analyse manufacturing and/or assembly information, using all of the following: a. strengths, weaknesses, opportunities and threats (SWOT) analysis b. force field analysis c. critical success factor/process matrix d. process failure mode & effects analysis (PFMEA) e. weighted selection f. tree diagram g. attribute analysis h. fishbone diagram i. relationship diagram j. paired comparison k. mind map l. technology/state-of-the-art analysis

m. other (specify)

1.6 produce the conceptual design options

1.7 ensure that the designs comply to relevant regulations/directives, standards and guidelines, from one of the following:

a. international
b. national
c. manufacturer specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.8 develop, in consultation with relevant people, a realistic and thorough build plan for the manufacture and/or assembly of the new product

1.9 discuss and finalise the build plan with the client and any key stakeholders, making changes where necessary

1.10 critique the build plan against the appropriate DFM and/or DFA criteria

1.11 apply value management techniques to the build plan which includes all of the following:

a. identifies the non-value added activities and indicates alternatives
b. priorities and ranking any alternatives
c. includes a risk assessment of alternatives
d. identifies the most appropriate alternatives
e. provides costing recommendations for management approval
f. identifies expected benefits

1.12 determine the feasibility of achieving the desired build plan

1.13 record details of the build plan, consultation and evaluation process, in the appropriate information system

1.14 present the build plan to the appropriate people, according to agreed procedures

1.15 communicate results of the design activities using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to produce new product designs for manufacture and assembly
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the specific health and safety requirements that apply to the product manufacturing and/or assembly process to be designed 2.4 explain how to obtain details of the specification of the product and equipment used in the manufacturing and/or assembly process that is to be designed 2.5 explain the types of design constraints that should be considered 2.6 explain the different types of build plan that could be required, including new/state-of-the-art technology 2.7 explain the types of information and level of detail that should be included in a build plan 2.8 explain how to structure and run a value management activity 2.9 explain how to carry out function analysis 2.10 explain how to carry out process failure mode and effects analysis (PFMEA) 2.11 explain how to carry out design for manufacture (DFM) and/or design for assembly (DFA) activity 2.12 explain how to identify what a customer requires from a product manufacturing and/or assembly process 2.13 explain how to prioritise and rank the alternatives 2.14 explain how to complete a risk assessment of the alternatives 2.15 explain how to include the findings into build plan proposals 2.16 explain how to monitor and track build plan proposals through to implementation 2.17 explain the regulations and guidelines that are relevant 2.18 explain how to obtain information on regulations and guidelines 2.19 explain when a client should be consulted on a build plan 2.20 explain who should be informed and consulted on the various aspects of a build plan 2.21 explain the company systems for recording build plan information 2.22 explain the importance of using the company information systems 2.23 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 420 Plan and control new product manufacturing process benchmarking activities

UAN:	**J/505/1048**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 026 - Plan and control new product manufacturing process benchmarking activities
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to use a structured approach for comparing manufacturing processes of their organisation against the best available from other organisations. The learner will be required to identify gaps in current process performance. The learner will also be required to generate ideas and strategies for improvement that are agreed with all the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful implementation of the benchmarking activity, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their own actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design principles and processes. The learner will be fully conversant with analytical principles and techniques used in

benchmarking, such as strengths, weaknesses, opportunities, threats (SWOT) analysis, attribute analysis, fishbone diagram and weighted selection.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. plan and control new product manufacturing process benchmarking activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 conduct a process benchmarking activity for two of the following: a. machining b. welding c. assembling d. casting e. forming f. wiring g. testing/inspection h. packaging i. coating/covering j. electrical components k. electronic components l. fabrication m. joining n. pressing o. storing p. logistics/movement q. processing operations r. moulding s. laying up t. bonding/gluing u. heat treatment v. integrated technologies w. computer hardware/software x. new technologies y. other (specify) 1.3 obtain all customer requirements and the design specification for the new process

1.4 develop a benchmarking strategy for the new process/design

1.5 establish the criteria and procedures for process benchmarking for three of the following:

a. functionality
b. performance/specification
c. aesthetics
d. materials
e. purchase cost
f. regulatory requirements
g. training cost
h. utility cost/usage
i. maintenance
j. statistical capability
k. durability
l. interfacing
m. operating cost
n. safety
o. environmental
p. other (specify)

1.6 implement the benchmarking activity, using appropriate methods and techniques. to include all of the following:

a. establish the existing key competitor manufacturing processes
b. establish benchmarking criteria from customer requirements and potential new process specifications
c. obtain all available information on the competitor designs and assess them against the benchmarking criteria
d. identify gaps in current process performance
e. identify potential new technologies that could be included in existing and future processes
f. establish current state of the art for each of the identified benchmarking criteria
g. identify the processes that are the most effective at meeting existing and new customer requirements
h. generate ideas for improved process performance

1.7 analyse the data gained from the benchmarking activity, using approved techniques. to include three of the following:

a. strengths, weaknesses, opportunities and threats (SWOT) analysis
b. force field analysis
c. critical success factor/process matrix
d. design failure mode and effects analysis
e. weighted selection
f. tree diagram
g. attribute analysis
h. fishbone diagram
i. relationship diagram
j. paired comparison
k. mind map
l. technology/state-of-the-art analysis
m. other (specify)

1.8 make recommendations as to where improvements can be made to

the design/product development

1.9 make recommendations where improvements to existing or new manufacturing processes should be used

1.10 present and record the results of the benchmarking exercise to the appropriate people, according to agreed procedures

1.11 communicate the results of the benchmarking exercise using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to plan and control new product manufacturing process benchmarking activities
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify, manage and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the organisational procedures and information systems for storing benchmarking data 2.4 explain the organisational activities required for the benchmarking process 2.5 explain the importance of establishing and recording responsibilities for benchmarking data collection 2.6 explain who should have responsibility for developing different parts of the benchmarking process 2.7 explain the various procedures that can be used in the benchmarking process 2.8 explain the principles and techniques used in structured process comparison 2.9 explain the factors that should be taken into account for disseminating information 2.10 explain the types of problem that could occur during the benchmarking process 2.11 explain the methods and techniques used to evaluate competitor products and processes 2.12 explain how to group critical success factors into categories (such as using fishbone diagrams or tree diagrams) 2.13 explain how to identify gaps in current process performance 2.14 explain what constitutes value adding and non-value adding activities

2.15	explain how to identify what a customer requires from a product and process
2.16	explain how to complete a risk assessment for using alternative new/state-of-the-art technology
2.17	explain how to use decision making and creativity techniques (such as brainstorming, to generate ideas for improvement)
2.18	explain how to prioritise and rank process improvement ideas
2.19	explain why it is important to have benchmarking exercises
2.20	explain what should be included in benchmarking plans
2.21	explain how to prioritise and schedule benchmarking activities
2.22	explain how to obtain information on key competitor products and processes
2.23	explain how to determine what resources are necessary for the benchmarking exercise (such as competitor products, technical specifications/literature)
2.24	explain the regulations and guidelines that are relevant
2.25	explain how to obtain and interpret information on regulations and guidelines
2.26	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 421 Establish manufacturing process design brief for new product introduction

UAN:	**L/505/1049**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 027 - Establish manufacturing process design brief for new product introduction
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to establish a manufacturing design brief for new product development and introduction (NPDI), in accordance with approved procedures. The learner will be required to consult with the client in order to obtain details and present a manufacturing process brief for new products, in accordance with approved procedures. The learner will be required to gather information from a number of sources to develop the brief, establishing application, function and constraints. The learner will also be required to discuss and communicate the proposals with the client and all other relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful production of the manufacturing process brief, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their own actions and, possibly, for the work of colleagues or subordinates. The learner's knowledge will provide a good

understanding of general and discipline-specific design principles and processes. The learner will be fully conversant with organisational procedures and systems. The learner will understand manufacturing process principles, and patent, copyright and intellectual property issues, and will know about project planning and resource management techniques, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. establish manufacturing process design brief for new product introduction
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 carry out all of the following activities to establish the new manufacturing process design brief: a. identify with the client the reasons or application for the new NPDI manufacturing design process, and establish any constraints which may affect it b. review the critical operational/functional requirements and quality criteria of the NPDI manufacturing process design c. clarify with relevant people any aspects of the manufacturing process design that are ambiguous d. produce the proposed NPDI manufacturing process brief and discuss any changes needed to suit the operational/functional requirements with relevant people e. ensure that the NPDI manufacturing process design brief meets relevant regulations and guidelines f. obtain agreement and sign-off of the NPDI manufacturing process design brief with the client 1.3 obtain accurate information on the manufacturing requirements of the client. to include one of the following: a. external – existing client b. external – potential client c. internal – existing organisational requirement d. internal – new organisational opportunity 1.4 obtain accurate information to establish manufacturing process

design objectives and specifications for six of the following NPDI requirements:

a. aesthetics
b. quality characteristics
c. function
d. performance
e. resources
f. delivery schedule
g. usability
h. materials
i. performance
j. cost
k. interfacing
l. technology
m. components
n. durability

1.5 establish information for the development of the NPDI manufacturing process design brief from two of the following sources:

a. existing designs
b. research
c. tests or trials
d. client
e. suppliers
f. general or specialist media
g. specialists/experts
h. engineering department
i. user groups

1.6 identify any unique or specific manufacturing features that need particular consideration

1.7 establish the manufacturing process design brief constraints, considering four of the following:

a. customer acceptability
b. time availability
c. cost of resources
d. capacity
e. copyright
f. departmental
g. legal
h. international/national standards
i. environmental
j. logistical
k. safety
l. commercial/prestige

1.8 determine the feasibility of achieving the client's manufacturing requirements

1.9 identify clearly any NPDI manufacturing process design constraints

1.10 incorporate all necessary details into the manufacturing design brief

1.11 produce a NPDI manufacturing process design brief that effectively encapsulates the requirements of the client. to include all of the

following:

a. confirmation of objectives
b. manufacturing process flow diagrams
c. feasibility of achieving requirements
d. description of proposed implementation, including any special features
e. detail of specific issues for consideration (such as quality assurance, health and safety, impending regulation changes, emerging technology)
f. NPDI manufacturing process design installation review process

1.12 ensure that the NPDI manufacturing process design brief complies with all relevant regulations and guidelines. to include one of the following:

a. international
b. national
c. manufacturer specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.13 clarify and agree the NPDI manufacturing design brief with the client

1.14 confirm that all participants in the design process are aware of the NPDI manufacturing process design brief

1.15 communicate the manufacturing process design brief using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

1.16 record the NPDI manufacturing process design brief in the appropriate information systems

Learning outcome
The learner will: 2. understand how to establish manufacturing process design brief for new product introduction
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI manufacturing process design programme 2.3 explain how to obtain details of the specification of the new product for the new manufacturing process to be designed 2.4 explain the types of manufacturing process design constraints that

should be considered

2.5 explain the different types of existing manufacturing process design brief that could be required

2.6 explain the types of information and level of detail that should be included in an NPDI manufacturing process brief

2.7 explain when a client should be consulted on an NPDI manufacturing process design brief

2.8 explain who should be informed and consulted on the various aspects of a new manufacturing process design brief

2.9 explain how to obtain and interpret legislation and regulatory documentation

2.10 explain the clients that they normally work with, and how they fit into the supply chain

2.11 explain how to obtain information from a client, and how to assess whether it is accurate

2.12 explain who they should deal with in a client's organisation

2.13 explain the procedures for contacting the client's organisation

2.14 explain the types of information necessary for establishing NPDI manufacturing process design requirements

2.15 explain the organisational procedures and information systems for storing NPDI manufacturing process design data

2.16 explain the various technologies that can be used in the NPDI manufacturing process design concepts, and the hazards associated with them

2.17 explain the equipment and methods used to produce the NPDI manufacturing process design concepts

2.18 explain the extent and limit of their own organisation's capabilities for producing various new product designs

2.19 explain the types of design feature that should be considered unique, and why it is important to give these particular consideration

2.20 explain the factors that should be taken into account for disseminating NPDI manufacturing process design information

2.21 explain the types of problem that could occur during the manufacturing process design concept process

2.22 explain the methods and techniques used to evaluate manufacturing process design concepts

2.23 explain why it is important to generate a range of manufacturing process design concepts

2.24 explain how to conduct a risk assessment of the various manufacturing process design concepts, and how to identify associated contingency plans to minimise their effect

2.25 explain how to determine what resources are necessary for the manufacturing process design concept exercise

2.26 explain how to access the feasibility of achieving the client's requirements for the new manufacturing process design

2.27 explain how to present an NPDI manufacturing process design brief to the client, and the importance of selecting the most appropriate method of presentation

2.28 explain how to obtain and interpret relevant information on regulations and guidelines

2.29 explain the organisational process or procedure for recording new manufacturing process design requirements, and the importance of using this

2.30	explain the extent of their own responsibility and their level of authority when dealing with clients
2.31	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 422 Develop a new product manufacturing process design strategy

UAN:	**F/505/1050**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 028 - Develop a new product manufacturing process design strategy.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to develop a strategy for the manufacturing process design, in accordance with approved procedures. The learner will be required to identify the process activities that need to be undertaken, and to allocate responsibilities and resources to each activity. The learner will also be required to observe procedures for disseminating process design information, develop a process design strategy and present this to the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful development of the manufacturing process design strategy, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's knowledge will provide a good understanding of general and discipline-specific design principles and processes. The learner will be fully conversant with

organisational procedures and systems, and they will also know about resource management, the design process in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. develop a new product manufacturing process design strategy
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations/directives and guidelines 1.2 carry out all of the following activities in developing a process design strategy: a. establish a means of storing process documentation and version control (configuration management) b. establish criteria for testing and validation of process design c. establish criteria for the process design (equipment, tooling) d. identify the activities that make up the process design e. establish the responsibility to each activity f. identify the resources required g. identify potential critical problems and effective contingency plans accordingly h. develop a schedule for the process design i. ensure that the strategy takes into account regulations/directives and guidelines j. communicate information to the appropriate people and to the quality management system 1.3 identify the process activities that need to be undertaken 1.4 establish the activities that will make up the process design, including all of the following: a. confirmation of requirements b. review of reference materials c. review historical records for past failures/poor performance 1.5 establish the appropriate procedures to be used during the process design, from all of the following: a. disseminating information b. obtaining resources c. reviewing designs (product, process) d. change management

e. configuration management
f. resource procurement

1.6 establish the responsibilities for developing specific aspects of the manufacturing process

1.7 review and evaluate historical records from similar process activities

1.8 identify any potentially critical problems and establish effective contingency plans

1.9 evaluate appropriate lean techniques for inclusion in the process design. to include three of the following:
a. single-piece flow
b. JIT
c. Kanban
d. Poke Yoke
e. cellular manufacture
f. takt time
g. design for flexible manning
h. bottleneck/constraint management

1.10 ensure that the process design strategy complies with relevant regulations, standards and guidelines. to include one from the following:
a. international
b. national
c. manufacturer specific
d. company policy and procedures
e. industry specific
f. statutory bodies

1.11 make recommendations where improvements to existing or new manufacturing processes should be used

1.12 present and record the results of the exercise to the appropriate people, according to agreed procedures

1.13 communicate the results of the manufacturing process design exercise, and record it in the relevant company information systems by the following methods:
a. a verbal report

plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to develop a new product manufacturing process design strategy
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant

	regulations/directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken
2.2	explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme
2.3	explain the manufacturing processes, skills and people required for the design of the current product range
2.4	explain the organisational procedures and information systems for storing process design data and configuration management
2.5	explain the organisational activities required for the process design
2.6	explain the importance of establishing and recording responsibilities
2.7	explain the various procedures that can be used in the process design
2.8	explain the factors that should be taken into account for disseminating information
2.9	explain the types of problem that could occur during the process design
2.10	explain the principles and application of lean manufacturing techniques to the workplace
2.11	explain why it is important to have contingency plans
2.12	explain what should be included in contingency plans
2.13	explain how to prioritise and schedule manufacturing design activities
2.14	explain how to obtain information on resources
2.15	explain how to determine what resources are necessary
2.16	explain how to determine the availability of resources
2.17	explain the regulations and guidelines that are relevant
2.18	explain how to obtain and interpret information on regulations and guidelines
2.19	explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 423 Develop a new product manufacturing process flow and floor plan layout

UAN:	**J/505/1051**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 029 - Develop a new product manufacturing process flow and floor plan layout.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to develop process flow and floor plan layouts for the manufacture of a new product. The learner will be required to establish customer requirements for new product, organisation capacity requirements and operating patterns. The learner will also be required to calculate takt time and construct a process flow chart for the new product. The learner's responsibilities will require them to comply with organisational policy and procedures for establishing the production cell requirements for the manufacture of the new product. The learner will need to produce the optimal manufacturing layout in the space available for manufacture, and to obtain sign-off for these plans from the appropriate stakeholders. The learner will also report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or with the team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's knowledge will provide a good understanding of general and discipline-specific manufacturing principles and processes. The learner will be fully conversant with organisational procedures and systems for development of process flow and floor plan layouts of new products, in the context of their own expertise and area of responsibility.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. develop a new product manufacturing process flow and floor plan layout
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations/directives and guidelines 1.2 carry out all of the following activities in a planning activity: a. plan the appropriate way to identify customer delivery requirements b. obtain all the necessary capacity requirements data c. construct process flow chart and floor plan layouts, using the appropriate media (such as computer software) d. communicate information to the appropriate people 1.3 establish customer delivery requirements for the new product. to include all of the following: a. capacity planning volumes (CPV) b. delivery logistics (eg, pallet size) c. daily planning volumes (DPV) 1.4 establish organisational capacity requirements including operating patterns 1.5 establish organisational budget constraints for the development exercise. to include all of the following: a. capital b. tooling c. revenue d. skills available e. premises (such as alterations, new buildings) f. performance (such as staff needed) g. margins h. other (specify)

1.6 calculate takt time using data from organisational capacity requirements

1.7 construct a process flow chart for the new product. to include all of the following:
   a. travel
   b. inspection/testing
   c. finished goods storage
   d. manufacturing operations
   e. rework
   f. WIP storage
   g. materials storage

1.8 establish production cell requirements for the manufacture of the new product. to include all of the following:
   a. manufacturing cell design (such as T, U, I, production line)
   b. gauging
   c. inventory levels
   d. fixture design
   e. operators required
   f. tool storage
   g. environmental requirements
   h. safety requirements (such as guarding, lifting)
   i. transfers (such as robots, roller track)

1.9 establish optimum layout in the space available for manufacture of the new product. to include all of the following:
   a. transport and movement of parts
   b. position of associated shared resource
   c. gangways and walkways
   d. storage areas (such as WIP, materials)
   e. load bearing requirements (such as floor, roofs)
   f. cranes and hoists
   g. availability of services (such as air, water, electricity)
   h. exits and entrances (such as fire)
   i. location of service departments (such as maintenance)
   j. obstructions (such as pillars, walls, pipework)
   k. building regulations (such as planning permission)
   l. other (specify)

1.10 ensure that the layouts comply with relevant regulations, directives, standards and guidelines, from one of the following:
   a. international
   b. national
   c. manufacturer specific
   d. company policy and procedures
   e. industry specific
   f. statutory bodies

1.11 obtain sign-off and agreement from stakeholders for proposed plans

1.12 record the results of the planning exercise, in accordance with agreed procedures

1.13 communicate with stakeholders, and record layouts in the relevant company information systems, by the following methods:
   a. verbal report

plus one of the following:

b. electronic mail
c. computer-based presentation
d. computer generated report
e. Specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to develop a new product manufacturing process flow and floor plan layout
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the organisational procedures and information systems for storing process flow and floor plan layout data 2.4 explain the importance of establishing and recording responsibilities for the new product process flow and floor plan layout process 2.5 explain who should have responsibility for the different parts of the process flow and floor plan layout process 2.6 explain the mechanism used to establish customer delivery requirements 2.7 explain how to establish organisational capacity requirements (including operating patterns) 2.8 explain how to calculate takt time 2.9 explain how to establish organisational constraints on working time (such as overtime limits, maintenance availability) 2.10 explain the various procedures that can be used in the process flow and floor plan layout process 2.11 explain the principles and techniques used in a process flow and floor plan layout planning exercise 2.12 explain the factors that should be taken into account for disseminating information before and after a process flow and floor plan layout planning process 2.13 explain the types of problem that could occur during the process flow and floor plan layout process 2.14 explain the organisational standards for the design of cells 2.15 explain the different types of cell design and tools/equipment used in them 2.16 explain the methods and techniques used to plan process flow and floor plan layouts 2.17 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 424 Plan and manage the installation of the new product manufacturing process

UAN:	**R/505/1053**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4): Unit 030 - Plan and manage the installation of the new product manufacturing process.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to plan and manage the installation of a new manufacturing process. The learner will be required to establish customer build dates and delivery schedule for the new product. The learner will need to establish the availability of shared and freely available in-house equipment for use in the new manufacturing process, as well as the need for new equipment and resources. The learner will also be required to identify and agree with sub-contractors/ machine builders' delivery plans for the new manufacturing process. The learner's responsibilities will require them to comply with organisational policy and procedures for establishing a master plan for the whole installation process and the facilities required. The learner will need to obtain sign-off for these plans from the appropriate stakeholders, prepare contracts for sub-contractors/machine builders, and manage installation activities against the agreed master plan. The learner will also report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or with the

team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's knowledge will provide a good understanding of general and discipline-specific manufacturing principles and processes. The learner will be fully conversant with organisational procedures and systems for development of plans for the installation of a new manufacturing process for a new product, in the context of their own expertise and area of responsibility.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. plan and manage the installation of the new product manufacturing process
Assessment criteria
The learner can: 1.1 confirm customer build dates and delivery schedule requirements for the new product 1.2 carry out all of the following activities in the planning activity: a. prepare installation plans against customer delivery requirements b. construct a master plan that includes delivery, removal and installation plans c. manage the installation of the new manufacturing process against the master plan d. communicate information to the appropriate people 1.3 determine organisational availability of in-house equipment against the planned manufacturing layout to include both of the following: a. shared existing resource b. freely available resource 1.4 establish new equipment and resource requirements against all of the following: a. off the shelf b. custom built c. storage (such as shelving, floor space) d. additional facilities in existing production areas (such as buffer stock)

1.5 create delivery plans for in-house/new equipment and resources against the planned manufacturing layout

1.6 determine removal/disposal plans for redundant services and equipment from the planned manufacturing area

1.7 establish service requirements for all of the following:

a. electrical supplies
b. water supplies
c. coolant supplies
d. pneumatic supplies
e. gas supplies
f. heating
g. lighting
h. environmental controls
i. fire equipment and alarms
j. waste streams
k. other (specify)

1.8 establish installation plans for new services in the new manufacturing area against the agreed floor plan layout

1.9 identify and agree individual delivery plans with sub-contractors/machine builders for the manufacturing area

1.10 construct a master plan for the installation of the new manufacturing process against agreed floor plan layout. to include all of the following:

a. key customer dates
b. in-house/new equipment delivery and resources plan
c. redundant equipment/services removal plan
d. installation plan against agreed floor plan layout
e. restricted access/barriers needed
f. allocation of responsibilities
g. key contact persons
h. special access/transport requirements
i. critical activities
j. equipment/service inter-dependencies
k. health and safety requirements
l. delivery storage requirements
m. other (specify)

1.11 agree sub-contractor/machine builder plans that include all of the following categories:

a. cost breakdown
b. delivery schedules
c. performance guarantees
d. quality standards
e. construction design management (CDM)
f. health and safety requirements
g. acceptance criteria
h. other (specify)

1.12 ensure that all plans comply with relevant regulations, standards and guidelines, from one of the following:

a. international
b. national
c. manufacturer specific

d. company policy and procedures
e. industry specific
f. statutory bodies

1.13 obtain sign-off and agreement from stakeholders for the master plan

1.14 implement and manage the installation of the new manufacturing process against the master plan

1.15 report project progress to relevant parties at the agreed stages of the plan

1.16 deal promptly and effectively with any problems during the installation process

1.17 record the results of planning and installation activities, in accordance with agreed procedures

1.18 communicate with stakeholders and record installation plans in the relevant company information systems, by the following method:

a. verbal report

plus one of the following:

b. electronic mail
c. computer-based presentation
d. computer- generated report
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to plan and manage the installation of the new product manufacturing process
Assessment criteria
The learner can: 2.1 explain the roles and responsibilities of themselves and others under the health and safety at work act 2.2 explain how to develop specific, measurable, realistic installation objectives and deliverables with sub-contractors/machine builders, allowing progress to be monitored and measured (smart) 2.3 explain the tools and techniques available for planning and monitoring the installation process 2.4 explain how to breakdown the installation process into individual deliverable activities/tasks 2.5 explain how to allocate specific activities/tasks and responsibilities for the installation process, in accordance with individual skills and abilities 2.6 explain how to determine the specialist help they may require during the installation process, and how this can be obtained 2.7 explain how to present information effectively to management, sub-contractors/machine builders, customers and others 2.8 explain how to solve problems and overcome barriers/difficulties encountered during the installation process 2.9 explain how to apply construction design management (cdm) techniques to ensure compliance with health and safety regulations for the people installing the new process 2.10 explain whom to liaise with and whom to obtain relevant and

specific information from to support and assist them during the planning and installation process

2.11 explain how to monitor progress of the installation process in terms of delivery on time, to budget, with agreed levels of quality

2.12 explain the organisational procedures and information systems for storing installation plans for new product data

2.13 explain the importance of establishing and recording responsibilities for new installation process

2.14 explain who should have responsibility for the different parts of the installation process

2.15 explain the mechanism used to establish customer build and delivery schedule requirements

2.16 explain how to establish the availability of in-house equipment against the planned manufacturing layout requirements

2.17 explain the factors to be considered in evaluating the availability of shared in-house and freely available equipment

2.18 explain the various procedures that can be used in the installation planning process

2.19 explain the principles and techniques used in an installation planning exercise

2.20 explain the factors that should be taken into account for disseminating information before and after an installation planning process

2.21 explain the types of problem that could occur during the installation process, and how to create plans that minimise their effects

2.22 explain the methods and techniques used to plan new services in a planned manufacturing area

2.23 explain the organisational guidelines and procedures for the development and agreement of contracts with sub-contractors/machine builders for new work

2.24 explain how to construct a master plan for the installation process and manufacturing facilities

2.25 explain how to use project planning software

2.26 explain the limits of their own authority, and to whom they should report if they have problems that they cannot resolve

Unit 425 Commission a new product manufacturing process

UAN:	**T/505/1059**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard: Lean New Product Development and Introduction (Suite 4) Unit 031 - Commission a new product manufacturing process.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to commission a new manufacturing process in accordance with approved procedures. The learner will be required to run pre-production trials for mass production of the new product. The commission process will also require the learner to identify and make improvements and fine tune the final manufacturing process for optimum efficiency. This will include liaising with clients to agree the relevant specifications, scheduling and obtaining resources, ensuring compliance with all regulations and guidelines, ensuring that requirements are achieved, and evaluating, recording and communicating the results of the commissioning process to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for the successful commissioning of a new manufacturing process. The learner will need to take account of any special customer requirements for outcomes required during the commissioning process. The learner will also report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or with the team, which they may lead or direct, taking

full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's knowledge will provide a good understanding of general and discipline-specific manufacturing principles and processes. The learner will be fully conversant with organisational procedures and systems for commission a new manufacturing process for new products, in the context of their own expertise and area of responsibility.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks, applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. commission a new product manufacturing process
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations/directives and guidelines 1.2 carry out all the following activities in a commissioning process: a. approve equipment and tooling for new manufacturing process b. ensure the commissioning complies with specification, regulations/directives and guidelines c. identify and obtain the required resources for the production trials d. implement and monitor pre-production and production trials e. solve problems from the pre-production and production trials f. fine tune the manufacturing process for optimum efficiency following the pre-production and production trials g. communicate appropriate information to all the relevant people h. maintain records for the quality management system 1.3 approve equipment and tooling against agreed specification at the suppliers premises for delivery of the goods to manufacturing area 1.4 ensure that adequate production materials are available for trialling equipment and tooling in the manufacturing area 1.5 consult with the relevant people to establish the most appropriate methods, techniques and activities to employ during commissioning, including four of the following: a. timing plan

b. authorisation channels
c. environmental requirements
d. configuration process
e. preparation of products
f. preparation of site
g. testing and/or trials
h. handover

1.6 initiate and monitor training of key personnel for the new manufacturing process. to include all of the following:
a. production team leaders
b. maintenance personnel
c. quality personnel
d. key equipment operators

1.7 arrange and monitor installation of equipment and tooling against the requirement of the master installation plan for the new manufacturing process

1.8 conduct safety checks of equipment and tooling used in the new process and address any non-conformances. to include all of the following:
a. safety barriers
b. safety guards
c. personal protective equipment (PPE)
d. trapping points
e. fume extractions
f. waste materials
g. access points
h. coolant extraction
i. dangerous emissions/substances
j. CE compliance
k. other (specify)

1.9 initiate and monitor small trials for individual equipment and tooling in the new process against required quality specifications

1.10 initiate and monitor process trials for equipment and tooling working in tandem to produce samples of the new product against required quality specifications

1.11 work with specialists to line-balance and achieve takt time for the new process. to include eight of the following:
a. equipment suppliers/designers
b. software specialists
c. maintenance personnel
d. quality engineers
e. purchasing personnel
f. bought-out parts suppliers
g. equipment specialists (such as robotics, lasers)
h. team leaders
i. process engineers (such as welding, painting)
j. logistics engineers (such as part supply/transport)
k. health and safety specialists
l. other (specify)

1.12 initiate and monitor planned production trials for the new process against an agreed master plan

1.13 conduct review of production trials problems with specialists and prioritise and plan actions to resolve them promptly and effectively

1.14 solve production trial problems using of two the of following methods:
   a. fish-bone diagrams
   b. 5 why technique
   c. Pareto analysis
   d. capability studies
   e. activity sampling
   f. tally charts
   g. other (specify)

1.15 initiate and monitor fine-tuning of components, jigs and fixtures to meet quality requirements for the finished product. to include two of the following:
   a. distortion following welding
   b. part fit up on assembly
   c. ease of equipment loading during assembly
   d. ease of product access for tools
   e. other (specify)

1.16 record the results of the commissioning activities in accordance with agreed procedures

1.17 communicate the results of the commissioning exercise, and record it in the relevant company information systems by the following methods:
   a. verbal communication
   b. visual management techniques

   plus one of the following:
   c. electronic mail
   d. computer-based presentation
   e. computer generated report
   f. specific company document
   g. other appropriate media

Learning outcome
The learner will: 2. understand how to commission a new product manufacturing process
Assessment criteria
The learner can: 2.1 explain the importance of working safely at all times, and of complying with health and safety and other relevant regulations, directives and guidelines, in the department/organisation where the new product development and introduction (NPDI) work is being undertaken 2.2 explain how to identify and minimise potential risks to health and safety that could occur during implementation of the NPDI programme 2.3 explain the organisational procedures and information systems for storing commissioning data 2.4 explain the organisational sign-off process and acceptance criteria

	for equipment and tooling at the supplier premises and at manufacturing area
2.5	explain the organisational activities required for the NPDI team's commissioning process
2.6	explain the importance of establishing and recording responsibilities for commissioning and analysis process
2.7	explain who should have responsibility for the different parts of the commissioning process
2.8	explain the various procedures that can be used in the commissioning and trialling review process
2.9	explain the principles and techniques used in a structured pre-production/product problem-solving review
2.10	explain the factors that should be taken into account for disseminating information before and after a commissioning process
2.11	explain how to conduct a health and safety risk analysis of the new manufacturing process
2.12	explain the types of problem that could occur during the commissioning process
2.13	explain the methods and techniques used to evaluate product quality specifications
2.14	explain how to use decision making and creativity techniques, such as brainstorming, to generate ideas for process improvement
2.15	explain how to prioritise and rank process improvement ideas
2.16	explain the sources of expert advice that may be accessed during the commissioning process
2.17	explain the organisational sign-off process and acceptance criteria for handover to production personnel at the end of the commissioning process
2.18	explain what should be included in plans for pre-production/production trials of new products
2.19	explain how to prioritise and schedule commissioning activities
2.20	explain the limits of their own authority, and whom they should report to if they have problems that they cannot resolve

Unit 426 Solve engineering or manufacturing problems

UAN:	**A/505/0933**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 03: Solve engineering or manufacturing problems (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to solve engineering or manufacturing problems, in accordance with approved procedures. Problems could occur in any aspect of engineering, such as in design, development, procurement manufacturing, installation, commissioning production, maintenance, testing and quality control, and the learner will be expected to take prompt and appropriate action to rectify the problem. The learner will be required to investigate the problem, obtaining all the necessary information to enable them to identify and evaluate possible solutions, and their effects on both the engineering process and on the people involved. They will also be expected to decide on a plan of action, and to communicate this to the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for the successful solution of engineering problems, and to report any difficulties that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering or manufacturing principles and processes. They will be fully conversant with organisational procedures and systems, including methods of evaluating the outcomes of the problem solving activity. Their underpinning knowledge will enable them to take an informed approach to applying problem solving techniques and procedures to a range of engineering or manufacturing problems, and will provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. solve engineering or manufacturing problems
Assessment criteria
The learner can: 1.1 carry out all of the following during the problem solving activity: a. discuss/consult with the relevant people on the nature and extent of the problem b. gather information from appropriate sources to help identify and define the problem c. identify and evaluate possible solutions, considering temporary, short term and long term solutions d. communicate the proposed solution to the relevant people, obtaining feedback where appropriate e. prepare a plan of action for implementation of the appropriate solution f. ensure that the agreed solution is implemented in an effective and timely manner g. ensure that the agreed solution complies with appropriate regulations and guidelines h. monitor the implementation of the solutions and make necessary revisions to the plan of action (plan do check act) 1.2 take prompt action to solve problems and keep all relevant people informed of progress 1.3 take action to resolve engineering or manufacturing problems arising from four of the following:

a. assembly
b. manufacturing
c. installation
d. commissioning
e. process operations or sequencing
f. maintenance
g. quality
h. material handling or processing
i. deviation from component/product specification
j. equipment malfunction
k. ergonomics related
l. utilities supply (such as gas, electricity, water, air)
m. time or schedule problem
n. safety related
o. personnel problem
p. external contractual problem
q. lack of resources/materials
r. environmental problem (pollutants, temperature, irritants, waste materials)
s. change to requirements (such as customer request)
t. design related
u. research and development
v. company strategy
w. deviation from departmental procedures, policies or work instructions
x. the customer (internal and/or external)
y. other problem (specify)

1.4 obtain all relevant information relating to the engineering or manufacturing problems

1.5 obtain and use information on the problem from four of the following:

a. statistical data
b. historic records (such as maintenance or shift logs)
c. quality audits
d. external sources
e. feedback from users, colleagues or customers
f. operating procedures/manufacturing manuals
g. company procedures
h. health and safety information
i. environmental documents/reports
j. process mapping
k. approved and controlled tests, trials or experiments
l. observation

1.6 identify correctly the nature, extent and root cause of any engineering or manufacturing problems that arise

1.7 evaluate all realistic engineering solutions to solve engineering or manufacturing problems

1.8 evaluate possible solutions to the problems, by considering six of the following:

a. operational effectiveness
b. ease of implementation

c. timescale for implementation
d. financial impact
e. customer impact (internal and/or external)
f. regulations, standards, directives or codes of practice
g. functionality of the system, product, component, or equipment
h. environmental impact
i. staffing implications
j. training and development
k. conformity with company policies, procedures or work instructions
l. health and safety implications
m. other (specify)

1.9 identify the most effective solution for solving engineering or manufacturing problems

1.10 implement engineering solutions for two of the following timescales:
a. temporary (interim solution)
b. short term (will require further action)
c. long term (permanent solution)

1.11 ensure that solutions are implemented correctly and promptly

1.12 ensure that the solutions to engineering or manufacturing problems comply with three of the following:
a. organisational guidelines and codes of practice
b. equipment manufacturer's operating specification
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards
e. customer standards and requirements specification
f. British, European, International standards or directives

1.13 report and communicate solutions to problems, using:
a. verbal report

plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to solve engineering or manufacturing problems
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the engineering or manufacturing area 2.2 explain the importance of wearing protective clothing and other appropriate safety equipment during the investigation of the problem, and where it may be obtained 2.3 explain how to obtain details of engineering or manufacturing

problems

2.4 explain the importance of getting to the root cause of the problem

2.5 explain the techniques used to get to the root cause of the problem such as the 5 why analysis, cause and effect diagrams, fault trees, flowcharting, process flow analysis

2.6 explain the criticality of different types of problem, and how to prioritise the problems to be solved

2.7 explain methods used to contain the problem such as in relation to non conformance of a product of process

2.8 explain how to obtain and interpret relevant data and information such as drawings, charts, specifications, manufacturers' manuals, history/maintenance reports and other documents needed for the problem solving process

2.9 explain the engineering or manufacturing processes and operating procedures within the area of their responsibility

2.10 explain the engineering or manufacturing principles and processes within the function where the problem exists

2.11 explain how to, obtaining any necessary ancillary equipment or resources, to support the investigation or solution to the problem under investigation

2.12 explain the typical problems that occur in your area of responsibility

2.13 explain the factors that have to be taken into account when selecting the solution to a problem

2.14 explain the techniques used to obtain information on problems, and the sources of information

2.15 explain what factors need to be taken into consideration when prioritising the problems to be solved

2.16 explain the methods and techniques involved in evaluating information

2.17 explain the factors to be taken into account when selecting the corrective action to a problem

2.18 explain the methods used to monitor the effectiveness of the corrective action

2.19 explain why it is important to review the problem solving process to understand the lessons learned

2.20 explain how to obtain and interpret relevant documentation associated with legislation, regulations, standards, directives or codes of practice

2.21 explain how to obtain and interpret company policy and personnel procedures

2.22 explain the reporting procedures and documentation, and their application

2.23 explain who to inform of actions taken, and by what means

2.24 explain how to retrieve necessary data from company information systems

2.25 explain the types of monitoring systems/techniques available, and their application

2.26 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 427 Undertake Project Management Activities

UAN:	**T/505/0963**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 33 Undertaking project management activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out project management activities in an engineering manufacturing environment. It involves identifying the need for a project and determining its scope and then developing this into a fully detailed project plan. The learner will be required to form a suitable project team taking into account the technicalities within the project and the individual skills and abilities of the team members. The learner will also be expected to determine and agree the individual roles and responsibilities of the team members and to set realistic and achievable goals for both the individuals within the team and the team as a whole. Obtaining appropriate authority and support for the release of resources to carry out the project is also included and this will include people, work space/work area, documentation and information. Monitoring the performance of the project to ensure that it meets the identified objectives also features in this standard. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken and to report any problems that they cannot solve, or are outside their responsibility, to the relevant authority. The learner must ensure that the project is delivered on time; to cost and to the required quality/outcomes

and that all necessary project documentation is completed accurately and legibly. The learner will be expected to take full responsibility for the decisions that they make and the overall performance of the project.

The learner's underpinning knowledge will be sufficient to provide a good understanding of project management, and provide an informed approach to the techniques and procedures used. The learner will need to understand the various techniques of project management and of team building, coaching, monitoring performance and communication methods available to them in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Learning outcome
The learner will: 1. undertake project management activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 ensure that the project delivery and outcomes comply with three of the following: a. organisational guidelines and procedures b. recognised compliance agency/body's standards, directives or codes of practice c. equipment manufacturer's operating specification/range d. customer standards and requirements e. British, European or International standards or directives f. health, safety and environmental requirements 1.3 undertake project management activities in one of the following areas: a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining) b. product or system installation c. commissioning d. decommissioning or recycling e. environmental or sustainability f. operational processes (such as movement of materials and logistics) g. maintenance practices (such as preventative, corrective, predictive, reactive or prevention) h. processing operations i. service supplies (such as gas, water, electricity) j. design k. research and development

l. engineering support functions (such as procurement, quality assurance, inspection, testing, scheduled safety audits and risk assessments, business improvement, finance, technical sales)

1.4 establish the need for the project and determine the project scope

1.5 gain authorisation to plan, undertake and complete the project outcomes

1.6 develop a full project plan which accurately identifies the project aims and objectives

1.7 develop project plans, which clearly identify all the following:

a. project outcomes and objectives
b. success criteria of the project
c. cost of the project
d. time scale required for the project
e. resources required
f. individual tasks within the project
g. milestones and deliverables to be met

1.8 obtain authorisation and support for the release of the necessary resources to carry out the project

1.9 consult with appropriate people in order to secure access to four of the following resources:

a. personnel
b. documentation and supporting data
c. finance
d. equipment
e. materials
f. facilities/work area
g. other specific resource

1.10 establish a project team with the skill sets required to deliver the project objectives

1.11 determine and agree individual roles and responsibilities within the project team

1.12 agree the review and monitoring processes and procedures to be used during the project.

1.13 monitor the project deliverables in accordance with the project plan

1.14 monitor and review the progress of the project to include all of the following:

a. project objectives are on target
b. issues or problems are highlighted and resolved
c. timelines are within agreed parameters
d. budgets are within agreed limits
e. agreed processes and procedures are being followed

1.15 report on project progress to relevant parties at the agreed stages

1.16 deal promptly and effectively with any problems within their control and report those that cannot be resolved

1.17 make adjustments the project plan where required and agreed

1.18 report project completion and closure to relevant personnel

1.19 report and communicate final project outcomes, using:

a. verbal report

plus one from the following:

b. computer-based presentation

c. computer generated report
d. specific company document
e. other appropriate media

Learning outcome
The learner will: 2. understand how to undertake project management activities
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the area the project is to be undertaken 2.2 explain the legislative, regulatory, standards, directives or codes of practices that must be adhered to 2.3 explain how to identify the project scope to determine the need for a full project plan and organisation approval 2.4 explain the factors that may affect the feasibility or constraints of the project 2.5 explain how to develop specific, measurable, realistic project objectives and deliverables, allowing progress to be monitored and measured 2.6 explain the criteria to determine if the project has been successful or not 2.7 explain the tools and techniques available for project planning and monitoring 2.8 explain how to communicate effectively, listen and question, provide feedback, support others 2.9 explain how to break the project down into individual deliverable tasks/metrics 2.10 explain the format and systems used for communicating the project aims, objectives and specific deliverables 2.11 explain how to form and develop the project team required to meet the identified objectives 2.12 explain how to allocate specific tasks and responsibilities to the project team members according to individual skills and abilities 2.13 explain the methods of assessing the project team performance 2.14 explain the importance of enabling the project team to contribute to the development and review of the project and the methods used to achieve this 2.15 explain how to determine the specialist help they may require in the project, and how this can be obtained 2.16 explain how to conduct a project meeting 2.17 explain how to present information effectively to management, peers, team members and customers 2.18 explain how to solve problems and overcome barriers/difficulties encountered during the life of the project 2.19 explain who to liaise with and who to obtain relevant and specific information from to support and assist them in running the project 2.20 explain how to monitor progress of the project in terms of delivery on time, to budget, with agreed levels of quality 2.21 explain how to negotiate changes to the project plan and secure agreement from all relevant parties

2.22	explain the importance of keeping all parties updated on the progress of the project and any changes that have been made
2.23	explain the implications for the project if changes are not communicated effectively
2.24	explain how to report project closure, completion and final status to management, teams and customers
2.25	explain the importance of evaluating the project and to identify where improvements could be made for future projects
2.26	explain the company systems for recording project outcomes
2.27	explain how limits of authority are agreed in the scope of the project
2.28	explain the process to be followed to identify whom they should report to in the event of encountering problems that they cannot resolve

Unit 428 Determine the Requirements for Engineering Activities

UAN:	**Y/505/0941**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 10: Determine the requirements for engineering activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to determine the requirements for engineering activities, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to interpret the requirements, to specify the quality criteria and to facilitate any necessary changes to the engineering activities. The leaner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful determination of engineering requirements, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems. They will understand quality assurance

principles and systems, and the appropriate specifications, details and formats, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. determine the requirements for engineering activities
Assessment criteria
The learner can: 1.1 carry out all of the following when determining the requirements for engineering activities: a. obtain details of the required engineering activity b. review the critical requirements and quality criteria of the activity c. clarify with relevant people any aspects of the activity that are unclear d. discuss and facilitate any changes needed to suit the engineering requirements, with the relevant people e. ensure that methods and procedures to be used meet relevant regulations and guidelines f. define the engineering requirements and communicate them to the relevant people 1.2 determine requirements for one of the following engineering activities: a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining) b. design c. research d. product or system installation e. commissioning f. decommissioning or recycling g. environmental or sustainability h. operational processes (such as movement of materials and logistics) i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention) j. processing operations k. service supplies (such as gas, water electricity l. engineering support functions (such as procurement, quality assurance inspection, testing, scheduled safety audits and

risk assessments, business improvement)

1.3 obtain accurate details of the engineering products or processes

1.4 obtain accurate details of the requirements for the engineering activity, from two of the following sources:

a. design office
b. production engineering
c. process engineering
d. quality engineering
e. sales department
f. safety engineering
g. plant engineering
h. industrial engineering
i. the client
j. contractors/specialists
k. component/product manufacturers
l. material/component supplier
m. HR/personnel

1.5 establish requirements for one of the following:

a. equipment/component/system capacity or capability studies
b. equipment/component/system performance
c. equipment/component/system life cycles
d. maintenance and repair
e. people performance
f. people capacity or capability
g. product or process quality
h. supplier capacity or capability
i. business support function capacity or capability

1.6 review and interpret the specification requirements of the engineering products or processes to assess their characteristics

1.7 clarify aspects of the engineering products or processes that are unclear

1.8 specify the quality criteria for the engineering products or processes

1.9 identify and confirm any changes to the engineering products or processes required to achieve the required outcomes

1.10 identify the methods, quality criteria and plans to be used, covering two of the following:

a. processing parameters
b. equipment preparation/selection
c. scheduling/planning
d. configuring/reconfiguring
e. inspection or testing
f. purchasing
g. safety checks/procedures
h. commissioning
i. installation
j. servicing, maintenance and repair
k. people responsibilities
l. product/process monitoring
m. financial monitoring
n. feedback/communication

o. movement of equipment/resources
p. stock control
q. logistics
r. business improvements
s. staff development
t. infrastructure requirements
u. co-ordinating contracts

1.11 ensure that the requirements comply with three of the following:
a. organisational guidelines and procedures
b. recognised compliance agency/body standards, directives or codes of practice
c. equipment manufacturers operating specification/range
d. British, European or International standards or directives
e. health, safety and environmental requirements
f. statutory bodies' requirements

1.12 agree and confirm any changes required with two of the following:
a. design department
b. production department
c. installation/commissioning team
d. customer
e. supplier
f. purchasing/buying department
g. quality/inspection department
h. contracting department
i. sales/marketing department
j. other personnel (please specify)

1.13 record the requirements in the appropriate information systems

1.14 record and communicate the requirements to the appropriate people, using:
a. a verbal report
b. plus one from the following:
c. electronic mail
d. computer generated report
e. computer-based presentation
f. specific company document
g. other appropriate media

Learning outcome
The learner will: 2. understand how to determine the requirements for engineering activities
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the engineering activities to be carried out 2.2 explain how to obtain details of engineering requirements from company information systems 2.3 explain how to interpret drawings, charts, specifications, information, data, reports, manuals and other documents needed

	to understand the requirements of the engineering activity
2.4	explain the critical characteristics of engineering activities
2.5	explain the methods and techniques for assessing and clarifying aspects of engineering activities that could be unclear
2.6	explain the quality criteria that apply to the particular engineering activity
2.7	explain how to identify and interpret changes to requirements for engineering activities
2.8	explain who to contact for clarification of the engineering requirements
2.9	explain who should authorise any changes to engineering activities
2.10	explain the different methods that relate to engineering activities within their area of responsibility
2.11	explain how to predict and resolve potential problems with the engineering activities
2.12	explain how to specify and communicate engineering requirements to others
2.13	explain the importance of using the company information systems
2.14	explain the information systems that are in use within their organisation, and how to record data to the system
2.15	explain how to obtain and interpret legislative and regulatory documentation
2.16	explain how to obtain and interpret company policy and procedures
2.17	explain the relevant reporting procedures, documentation and their application
2.18	explain who to inform of actions taken, and by what means
2.19	explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 429 Produce Engineering Specifications

UAN:	**J/505/0935**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 05: Produce Engineering Specifications (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce engineering specifications based on client requirements, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to determine the feasibility of meeting the client requirements, and to notify the client of any changes that may be required. In addition, they will be expected to communicate the specifications and the rationale behind them to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful production of specifications, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions and, possibly, for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to

producing engineering specifications. They will have a thorough understanding of general and design-specific engineering principles and processes. They will also know about patents, copyright and intellectual property issues, and will be fully conversant with the company procedures, systems of operation and standard specification formats, in adequate depth to provide a sound basis for carrying out their activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. produce engineering specifications
Assessment criteria
The learner can: 1.1 obtain the design requirements from the company information system, or from one of the following types of client: a. external – existing client b. external – potential client c. internal – existing organisational requirement d. internal – new organisational opportunity 1.2 produce a specification for the engineering product or process that meets the requirements of the client 1.3 prepare specifications incorporating client requirements, to include six of the following: a. function b. performance/capability c. aesthetics d. materials e. manufacturing methods f. resources g. budget h. technologies i. volume j. life cycles k. timing/delivery schedule l. inspection/testing m. usability n. interfacing o. on going support

p. environmental/sustainability
q. packaging
r. communication plan
s. manufacturer's specifications
t. monitoring/servicing/maintenance frequency
u. specific/special facilities or equipment
v. other specific requirements

1.4 incorporate all necessary details into the specification
1.5 ensure that the specification is capable of being implemented
1.6 ensure that specifications comply with three of the following:
a. organisational guidelines and codes of practice
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards
e. customer standards and requirements
f. British, European or International standards or directives

1.7 consult with the client on all of the following:
a. evidence that the specifications are capable of being achieved
b. acceptability of specification formats and supporting documentation
c. any suggested changes to requirements, and why they are necessary
d. the regulations, directives and guidelines considered in the specification, and their implications

1.8 agree the specification with the client at appropriate points in the design process
1.9 provide a suitable rationale for any requirements that cannot be achieved or any changes to the specification
1.10 produce the specification in the agreed formats with the necessary supporting documents
1.11 record the specification in the appropriate information systems
1.12 record and communicate specifications to the appropriate people, using:
a. a verbal report

plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to produce engineering specifications
Assessment criteria
The learner can: 2.1 explain the different types of specification that are required by various clients 2.2 explain the types of detail that should be included in a specification 2.3 explain the appropriate level of detail that is required in a

	specification
2.4	explain how to assess whether the specification is capable of being achieved
2.5	explain how to consult with a client on a specification, and when it is most appropriate to do so
2.6	explain the types of change to a specification that could be necessary
2.7	explain how to identify alternatives when it is necessary to make changes to specifications
2.8	explain the different formats used for specifications, and their acceptability to the client
2.9	explain the regulations, directives and guidelines that are relevant to different types of specification
2.10	explain how to obtain and interpret information on regulations, directives and guidelines
2.11	explain the company systems for recording information
2.12	explain the importance of using the company information systems
2.13	explain the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 430 Specify Methods and Procedures to Achieve Engineering Requirements

UAN:	**D/505/0942**
Level:	3
Credit value:	9
GLH:	60
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 11: Specify methods and procedures to achieve engineering requirements for engineering activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to specify engineering methods and procedures, in accordance with approved organisational systems. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to select appropriate engineering requirements, and to specify the most effective methods and procedures to achieve them. They will also be required to identify the resources necessary to undertake the proposed methods and procedures. In addition, they will be required to identify any control parameters for equipment to be used in undertaking the engineering activities. The learner's responsibilities will require them to comply with organisational policy and procedures for the successful specification of engineering methods and procedures, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or

direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems. They will understand the engineering systems, techniques and technical requirements applicable to the engineering activity being undertaken.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. specify methods and procedures to achieve engineering requirements
Assessment criteria
The learner can: 1.1 carry out all of the following when specifying engineering methods and procedures: a. gather data on the requirements for engineering methods and procedures b. select the appropriate engineering activity for the engineering methods c. identify and evaluate control parameters and resources (including equipment, quality, materials and manpower) d. specify engineering activities, methods and procedures, and their implementation requirements e. ensure that the specified methods and procedures meet relevant regulations and guidelines 1.2 obtain accurate details of the engineering requirements for engineering products or processes 1.3 obtain accurate details of engineering requirements from the appropriate company information system or sources, including four the following: a. production department b. maintenance department c. contractors/specialist d. material control department e. design department f. research specialists

g. quality assurance/control department
h. equipment manufacturers
i. personnel/HR department
j. operating procedures/manufacturing manuals
k. company procedures
l. health and safety information
m. environmental/sustainability sources
n. environmental documents
o. external sources
p. specific plant/utility installations
q. sales and marketing
r. purchasing department
s. contracting department
t. British, European or International standards or directives
u. other (to be specified)

1.4 identify the engineering activity required to implement the engineering methods, from one of the following:
a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining)
b. design
c. research
d. product or system installation
e. commissioning
f. decommissioning or recycling
g. environmental or sustainability
h. operational processes (such as movement of materials and logistics)
i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention)
j. processing operations
k. service supplies (such as gas, water electricity
l. engineering support functions (such as procurement, quality assurance inspection, testing, scheduled safety audits and risk assessments, business improvement

1.5 select the most effective methods to achieve engineering requirements

1.6 identify the resources needed to implement the engineering methods, to include two of the following:
a. personnel
b. materials
c. facilities
d. process
e. equipment
f. finance

1.7 identify the activities required to achieve the engineering requirements

1.8 identify the control parameters for the equipment to be used

1.9 specify clearly the methods and procedures to be used

1.10 specify engineering methods and procedures, using one of the following:
a. paper based documentation

b. computer based documentation
c. combined paper and computer based presentation

1.11 ensure that the methods and procedures comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.12 record the methods and procedures in the appropriate information systems

1.13 record and communicate details of the methods and procedures to the appropriate people, using:
a. a verbal report

plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to specify methods and procedures to achieve engineering requirements
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to their area of responsibility or activity 2.2 explain the implications of risk assessment, safety and environmental systems, and their application to engineering methods and procedures 2.3 explain how to obtain details of engineering requirements from company information systems 2.4 explain how to obtain and interpret drawings, charts, specifications, manufacturers' manuals, history/maintenance reports and other documents needed to specify methods and procedures 2.5 explain the communication and research techniques that could be used to obtain the necessary information 2.6 explain the engineering principles, processes and procedures undertaken in the area of their responsibility 2.7 explain the engineering methods that could be used for different types of engineering process or activity 2.8 explain the different types of equipment, and how they should be used for various engineering methods 2.9 explain the engineering activities that could be used for different engineering methods

2.10	explain the approved company format for presenting engineering methods and procedures
2.11	explain how to obtain information on resources
2.12	explain how to determine the resources that are necessary
2.13	explain how to determine the availability and suitability of resources
2.14	explain who will require the procedures being specified
2.15	explain the different types of procedure to be used for different groups of people
2.16	explain the level of detail and content required for engineering procedures
2.17	explain the regulations and guidelines applicable to their area of responsibility
2.18	explain how to obtain information on regulations and guidelines
2.19	explain how to obtain and interpret company policy and personnel procedures
2.20	explain the methods and procedures for recording new systems or working practices
2.21	explain the company systems for recording information
2.22	explain the importance of using the company information systems
2.23	explain who to inform of actions taken, and by what means
2.24	explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 431 Schedule Engineering Activities

UAN:	**H/505/0943**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 12: Schedule Activities for Engineering Methods and Procedures (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to schedule engineering activities, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be expected to identify relevant methods, processes, procedures and resources, and to issue engineering schedules. They will also be able to demonstrate how to deal with any scheduling difficulties that arise. The learner's responsibilities will require them to comply with organisational policy and procedures for the successful implementation of engineering activities, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant

with organisational procedures and systems. They will understand scheduling, resource management, and project planning and management, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

They will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. schedule activities for engineering methods and procedures
Assessment criteria
The learner can: 1.1 carry out all of the following when scheduling operational activities: a. refer to any existing schedules that may be appropriate b. determine the engineering activities to be scheduled c. identify applicable engineering methods, processes and procedures (including any specific sequencing requirements) d. identify and schedule time and resources e. review the schedule, and develop contingency plans to eliminate any difficulties f. ensure that the schedule complies with all relevant regulations, standards and guidelines g. communicate the schedule to all relevant people 1.2 confirm the activities and resources that are required to achieve the engineering methods and procedures 1.3 obtain data for engineering activities from three of the following: a. management b. client c. quality engineering d. safety engineering e. technical data, charts, reference tables or manuals f. design office g. plant engineering h. suppliers i. production engineering j. industrial engineering k. process engineering l. purchasing m. company information system n. HR/personnel o. external technical consultants/experts

1.4 identify the most suitable sequence of activities

1.5 establish requirements for one of the following:
- a. equipment/component/system capacity or capability
- b. equipment/component/system performance
- c. equipment/component/system life cycle
- d. maintenance and repair
- e. people performance
- f. people capacity or capability
- g. product or process quality
- h. supplier capacity or capability
- i. business support function capacity or capability

1.6 schedule engineering activities for one of the following:
- a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining)
- b. design
- c. research
- d. product or system installation
- e. commissioning
- f. decommissioning or recycling
- g. environmental or sustainability
- h. operational processes (such as movement of materials and logistics)
- i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention)
- j. processing operations
- k. service supplies (such as gas, water electricity)
- l. engineering support functions (such as procurement, quality assurance inspection, testing, scheduled safety audits and risk assessments, business improvement)

1.7 schedule the time and resources available for undertaking the activities

1.8 ensure that schedules are capable of meeting all relevant requirements

1.9 prepare and review schedules of resources, including four of the following:
- a. personnel
- b. skills required
- c. equipment
- d. facilities
- e. materials
- f. finance
- g. time

1.10 incorporate new schedules into the engineering process with minimal disruption

1.11 identify potential difficulties and produce appropriate contingency plans

1.12 confirm that schedules meet requirements, or produce a contingency plan, including one of the following:
- a. agree revised requirements with management/client
- b. change timescales in agreement with management/clients
- c. reschedule

d. obtain additional/alternative resources
e. recommend a change to the process
f. other specific change

1.13 ensure that schedules comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.14 specify clearly the schedules and record them in the appropriate information systems

1.15 report and communicate schedules to the appropriate people, using:
a. verbal report
plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome

The learner will:

2. understand how to schedule activities for engineering methods and procedures

Assessment criteria

The learner can:

2.1 explain the health and safety and environmental requirements applicable to the engineering schedule

2.2 explain how to interpret engineering schedules

2.3 explain how to obtain information on the processes to be scheduled

2.4 explain the different types of engineering activities, methods and processes

2.5 explain how different engineering activities relate to each other

2.6 explain how to determine the time and resources required for different types of engineering activity

2.7 explain the factors that should be accounted for when scheduling time and resources

2.8 explain the potential disruption that can be caused through the implementation of new engineering schedules

2.9 explain the methods and techniques for dealing with engineering difficulties

2.10 explain the approved techniques for the scheduling of engineering activities

2.11 explain how to develop contingency plans

2.12 explain the company systems for recording information

2.13 explain the importance of using the company information recording systems

2.14	explain the reporting procedures, documentation, and their application
2.15	explain who to inform of actions taken, and by what means
2.16	explain how to obtain and interpret legislative and regulatory documentation
2.17	explain how to obtain and interpret company policy and procedures
2.18	explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 432 Obtain Resources for the Implementation of Engineering Activities

UAN:	**K/505/0944**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 13: Obtaining resources for the implementation of engineering activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to obtain resources for the implementation of engineering activities, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner's will be required to apply appropriate methods for the identification and obtaining of resources, and they will be expected to resolve any issues relating to the resources in the appropriate manner. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful procurement of resources, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general

and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems. They will understand evaluation methods, resource management, and problem solving principles and procedures, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner's will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. obtain resources for the implementation of engineering activities
Assessment criteria
The learner can: 1.1 carry out all of the following when obtaining resources for engineering activities: a. select the engineering activity for which resources are required b. identify potential problems which may affect the provision of resources c. specify the resources required, and check for their availability d. obtain the resources, using the appropriate organisational procedures and authorisations e. resolve any resource supply or quality issues f. record all resource data on the appropriate company information system 1.2 assess the engineering requirements and any factors that could affect them 1.3 obtain and review resource information from two of the following sources: a. company information systems b. specifications c. production/planning documentation d. drawings or CAD data e. parts/component lists f. financial data g. purchase orders h. contracts i. electronic mail j. standard operating procedures k. personnel training records

l. other (to be specified)

1.4 specify clearly the resources required to implement engineering activities

1.5 specify the resources for three of the following:

a. people
b. materials
c. equipment
d. finance
e. facilities
f. information

1.6 consult with all relevant people on the resources that are available

1.7 use the appropriate organisational procedures to obtain the required resources

1.8 obtain resources for two of the following engineering activities:

a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining)
b. design
c. research
d. product or system installation
e. commissioning
f. decommissioning or recycling
g. environmental or sustainability
h. operational processes (such as movement of materials and logistics)
i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention)
j. processing operations
k. service supplies (such as gas, water electricity
l. engineering support functions (such as procurement, quality assurance inspection, testing, scheduled safety audits and risk assessments, business improvement

1.9 obtain the resources, using both of the following organisational procedures:

a. communication procedures
b. authorisation procedures

1.10 resolve any issues relating to the resources in the appropriate manner

1.11 resolve resource issues, including three of the following:

a. availability (materials, equipment, information, finance, people, facilities)
b. quality (materials, equipment, information, facilities)
c. skills (personnel)
d. time
e. other issues (such as timescales)

1.12 record information on the resources in the appropriate information systems

1.13 record and communicate details of the resources obtained, to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail

c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to obtain resources for the implementation of engineering activities
Assessment criteria
The learner can: 2.1 explain the specific health safety and environmental issues that apply to the implementation of the engineering activities 2.2 explain the engineering methods and procedures that could be used for different types of engineering activity 2.3 explain how to obtain details of engineering resource requirements from company information systems 2.4 explain the quality assurance systems that are being used 2.5 explain how to obtain information on resources 2.6 explain how to determine the necessary resources 2.7 explain how to determine the availability and suitability of resources 2.8 explain the procedures for obtaining resources 2.9 explain the types of issue that could occur when obtaining resources, and how to resolve them 2.10 explain the company systems for recording information 2.11 explain why it is important to use the company information systems 2.12 explain the regulations, directives and guidelines that are relevant 2.13 explain how to obtain and interpret information on regulations, directives and guidelines 2.14 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 433 Implement Engineering Processes

UAN:	**M/505/0945**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 14: Implement engineering processes (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to implement engineering processes, in accordance with approved organisational procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to apply appropriate methods to confirm that conditions are suitable for the implementation of engineering processes, and to ensure that clear instructions are given to the relevant people. During the implementation of the engineering processes, they will be required to ensure that quality assurance and engineering support systems are operating correctly, and that the necessary resources are available. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful implementation of the engineering processes, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of

colleagues or subordinates.

The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will also be fully conversant with organisational procedures and systems. They will understand the engineering processes being implemented, and will know about quality assurance and resource management, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. implement engineering processes
Assessment criteria
The learner can: 1.1 confirm that conditions are suitable to implement engineering methods and procedures 1.2 confirm conditions for four of the following: a. appropriate authorisation is obtained b. availability of resources c. preparation of products or processes d. preparation of site e. health and safety f. environmental 1.3 implement an engineering process for one of the following: a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining) b. design c. research d. product or system installation e. commissioning f. decommissioning or recycling g. environmental or sustainability h. operational processes (such as movement of materials and logistics) i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention) j. processing operations

k. service supplies (such as gas, water electricity)
l. engineering support functions (such as procurement, quality assurance inspection, testing, scheduled safety audits and risk assessments, business improvement)

1.4 provide clear and accurate instructions to all the relevant people

1.5 provide instructions for one of the following:
a. equipment/component/system capacity or capability
b. equipment/component/system performance
c. maintenance and repair
d. people performance
e. people capacity or capability
f. product or process quality
g. supplier capacity or capability
h. business support function capacity or capability

1.6 obtain accurate information on the activities being undertaken

1.7 obtain information from two of the following:
a. management
b. design office
c. industrial engineering
d. client
e. plant engineering
f. process engineering
g. quality engineering
h. suppliers
i. purchasing
j. safety engineering
k. technical data, charts, reference tables or manuals
l. production engineering
m. company information system
n. human resources (HR) personnel
o. external technical consultants/experts

1.8 ensure that quality assurance systems are correctly implemented

1.9 ensure that engineering support systems are operating correctly

1.10 control the use of resources to achieve the most effective results

1.11 ensure that all support and control systems operate effectively for two of the following:
a. quality assurance systems
b. transport
c. logistics
d. procurement
e. supervision or leadership structures
f. utilities
g. resource supply (such as materials, equipment, personnel)
h. other technical support requirements (to be specified)

1.12 identify opportunities to improve the engineering methods and procedures

1.13 implement engineering processes that comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range

c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.14 implement engineering processes that include four of the following:
a. a record of the implementation process on appropriate company media
b. an evaluation of the effectiveness of the implementation process
c. any deviations from specifications of the implemented activity
d. recommendations for improvements to the implemented activity
e. plans to monitor and evaluate the effect(s) of any improvements made to the implemented process

1.15 ensure that the implementation of engineering methods and procedures complies with all relevant regulations, directives and guidelines

1.16 report and communicate methods and procedures for the engineering process, using:
a. verbal report

plus one from the following:
b. electronic mail
c. computer generated report
d. specific company form
e. other appropriate media

Learning outcome
The learner will: 2. understand how to implement engineering processes
Assessment criteria
The learner can: 2.1 explain the methods and procedures that could be used for different types of engineering process 2.2 explain the conditions that are suitable and not suitable for different types of engineering process 2.3 explain how to obtain details of the engineering processes being implemented 2.4 explain the activities that are required for different engineering methods 2.5 explain the quality assurance systems that are being used 2.6 explain the engineering support systems that are operating 2.7 explain the procedures for obtaining information on resources 2.8 explain how to determine the necessary resources 2.9 explain how to determine the availability and suitability of resources 2.10 explain what type of impact the implementation could have on the organisation 2.11 explain who requires instructions on the engineering process or processes being implemented

2.12	explain the different and most appropriate ways of instructing people on the engineering process or processes
2.13	explain the types of recommendation that could emerge from evaluation of the implemented engineering process
2.14	explain the regulations, directives and guidelines that are relevant
2.15	explain how to obtain and interpret information on regulations, directives and guidelines
2.16	explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 434 Monitor and Evaluate Engineering Processes

UAN:	**T/505/0946**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 15: Monitor and evaluate engineering processes (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to monitor and evaluate engineering processes, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to apply appropriate methods and techniques to monitor and evaluate process outputs and the utilisation of resources. During the monitoring process, they will be required to highlight any deviation from agreed specifications, and to recommend appropriate corrective actions. The learner's responsibilities will require them to comply with organisational policy and procedures for the monitoring and evaluation of engineering processes, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of their work, and will enable them to take an informed

approach to applying monitoring and evaluation procedures. It will include general and discipline-specific engineering principles and processes. They will understand the monitoring and evaluation processes, and their application, in adequate depth to provide a sound basis for carrying out the activities to the required standard. They will also be able to present the outcomes of their monitoring and evaluation to the relevant people, using appropriate methods.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. monitor and evaluate engineering processes
Assessment criteria
The learner can: 1.1 plan the most appropriate way for evaluating the engineering process 1.2 establish clear and precise criteria for evaluating the engineering process 1.3 establish criteria for monitoring and evaluation of one of the following: a. equipment capability b. equipment performance measurement c. the use of computer based records systems for engineering processes 1.4 evaluate the effectiveness of the engineering process, taking into account six of the following: a. standard operating procedures/work instructions b. process/quality control or assurance documentation c. organisation documentation used (such as for purchasing, planning scheduling, contracting, sales and marketing) d. IT systems e. non conformances/defects f. use of equipment g. use of materials/resources h. staff training and development i. supplier data and information j. customer data and information k. schedules and plans

l. costs
m. available technologies
n. performance/capability
o. process outcomes
p. reliability
q. maintenance and repair
r. health and safety
s. environmental and sustainability factors
t. recycling
u. other (to be specified)

1.5 ensure that the monitoring and evaluation processes comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.6 obtain accurate information on the engineering process from all valid sources

1.7 monitor and evaluate two engineering processes for one of the following:
a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining)
b. design
c. research
d. product or system installation
e. commissioning
f. decommissioning or recycling
g. environmental or sustainability
h. operational processes (such as movement of materials, logistics)
i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention)
j. processing operations
k. service supplies (such as gas, water, electricity)
l. engineering support functions (such as procurement, quality assurance inspection, testing, scheduled safety audits and risk assessments, business improvement)

1.8 gather data from two of the following sources of information during the evaluation process:
a. monitoring and audit processes
b. clients
c. general media
d. benchmarking partners
e. colleagues
f. suppliers
g. specialised media

1.9 review all relevant information relating to the engineering process

1.10 prepare the results of the evaluation, to include all of the following:

a. an appraisal of the effectiveness of the engineering process
b. evaluation of the cost effectiveness of the engineering process
c. an appraisal of the compliance of the engineering process with defined criteria
d. a recommendation of feasible changes or improvements to the engineering process
e. a proposed method for monitoring the impact of the improvements to the engineering process
f. an appraisal of the effectiveness of evaluation process

1.11 consult with all relevant people during the evaluation
1.12 assess the potential impact of any changes to be recommended
1.13 recommend feasible changes or improvements to the engineering process
1.14 present the results of the evaluation to the appropriate people according to agreed procedures
1.15 report and communicate results of the monitoring and evaluation, using:
a. verbal methods

plus one from the following:
b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to monitor and evaluate engineering processes
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when monitoring and evaluating engineering processes 2.2 explain when to monitor and evaluate engineering processes 2.3 explain the quality assurance systems that are being used 2.4 explain the methods and tools that are available for monitoring and evaluating engineering process, and the procedures that should be used for evaluation 2.5 explain the evaluation criteria that should be used for each type of engineering process within their area of operation 2.6 explain the methods that could be used for obtaining information on the engineering processes 2.7 explain the relevant sources of information on a particular engineering process 2.8 explain how to obtain and interpret information on engineering processes 2.9 explain the people that should be involved in the evaluation process 2.10 explain the types of recommendation that could emerge from evaluations 2.11 explain the type and level of impact that could result from the

evaluation outcomes

2.12 explain the people requiring information on evaluations, and the procedures for informing them

2.13 explain the types of issue that could occur when monitoring and evaluating engineering processes, and how to resolve them

2.14 explain the company systems available for recording information

2.15 explain why it is important to use the appropriate company information systems

2.16 explain how to present information and recommendations

2.17 explain the regulations, directives and guidelines relevant to the engineering processes being monitored and evaluated

2.18 explain how to obtain and interpret information on the relevant regulations, directives and guidelines

2.19 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 435 Provide Technical Advice and Guidance on Engineering or Manufacturing Requirements

UAN:	**F/505/0951**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No 20: Providing technical advice and guidance on engineering or manufacturing requirements (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to advise and guide others in work-related engineering or manufacturing technical matters, in accordance with approved procedures. The learner will be expected to provide technical advice and guidance to others involved activities, such as design, installation, manufacturing, production, operational support activities, maintenance, or equipment capability/performance measurement. The learner will be required to identify suitable opportunities for offering technical guidance, to plan and apply appropriate methods in such guidance, and to keep their methods under review so that they can modify their approach where necessary. The learner's responsibilities will require them to comply with organisational policy and procedures when providing technical guidance, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the guidance they give.

The learner's underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to the methods, techniques and procedures for providing technical advice and guidance. The learner will understand the engineering or manufacturing activities and their application, and will know about them in adequate depth to provide a sound basis for giving the technical advice or guidance provided.

The learner will understand the safety precautions required in the work area where they provide technical guidance. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the work area.

Learning outcome
The learner will: 1. provide technical advice and guidance on engineering or manufacturing requirements
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines 1.2 understand the recipients requirements for technical advice or guidance 1.3 confirm that they have interpreted the requirements correctly and accurately 1.4 ensure that any data and information drawn upon for which advice and guidance is sought is up to date, valid, reliable and sufficient to meet the recipients requirements 1.5 ensure that any data and information drawn upon for which advice and guidance is sought is up to date, valid, reliable and sufficient to meet the recipients requirements 1.6 provide technical advice and guidance for two of the following groups of people: a. colleagues in the same work group b. colleagues outside work group c. contractors d. client/customers e. others working on related technical activity areas 1.7 provide technical guidance for one of the following activities: a. drawing/design activities (such as mechanical, electrical/electronic, automotive, aerospace, marine) b. manufacturing activities (such as machining, detail fitting, fabrication of components, pressing) c. material processing activities (such as heat treatment, casting, injection moulding, purification) d. composite manufacture (such as wet lay-up, pre-preg

laminating, resin infusion, blow moulding)
e. finishing activities (such as stripping finishes, painting, plating, anodising, veneering, lacquering)
f. assembly activities (such as mechanical, structural, fluid power, electrical/electronic, woodworking)
g. installation activities (such as mechanical, electrical/electronic, avionic, structural, environmental equipment)
h. plant and equipment (such as site preparation, plant layout, equipment changeover, equipment replacement)
i. equipment capability studies/performance measurement
j. movement of materials, components or finished goods
k. business improvement activities
l. engineering safety audits or risk assessments
m. quality control/quality assurance
n. maintenance activities
o. modification and repair activities
p. commissioning/decommissioning
q. research and development
r. testing and/or trialling
s. engineering support services
t. environmental/sustainability activities

1.8 provide technical advice and guidance on four of the following:
a. equipment operation
b. specific or specialist tools, equipment or components required
c. equipment/component/process performance parameters
d. materials required/used
e. physical characteristics of components or products
f. timing/delivery details
g. environmental considerations/operating conditions
h. cost/budget information
i. manufacturing methods
j. aesthetics/finish details
k. manufacturing detail
l. quality requirements/control
m. processing requirements
n. monitoring/servicing frequency
o. work instructions or procedures
p. training required
q. number/volume required
r. customer interface requirements
s. resource requirements
t. safety regulations and requirements
u. equipment/component interfacing

1.9 provide advice and guidance resulting from two of the following:
a. reported problems found during the engineering or manufacturing activity
b. recorded deviations from agreed plans and schedules
c. customer requests or complaints
d. training, development or mentoring

1.10 provide technical advice and guidance by the following methods:

a. specific company documentation
b. Plus by one other method from the following:
c. verbally
d. computer generated report
e. electronic mail
f. computer based presentation
g. other appropriate media

1.11 ensure technical advice and guidance provided is in line with company policies, procedures and constraints

1.12 ensure that the technical advice and guidance complies with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. recognised compliance agency/body's standards, directives or codes of practice
d. customer standards and requirements
e. British, European, International standards or directives
f. health, safety and environmental requirements

1.13 ensure that technical advice and guidance provided complies with any relevant legislation, standards, directives or codes of practice

1.14 provide appropriate technical advice and guidance to the recipient in the correct format and to agreed timescales

1.15 confirm the recipient understands the advice and guidance provided

1.16 provide any follow up advice and guidance where require

Learning outcome
The learner will: 2. understand how to provide technical advice and guidance on engineering or manufacturing requirements
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken in the work areas where technical guidance is being given 2.2 explain the regulations, directives and guidelines that are relevant to the work area 2.3 explain how to obtain information on regulations, standards, directives and guidelines 2.4 explain how to obtain and interpret drawings, charts, specifications or other documents that can be used when giving technical advice and guidance 2.5 explain the activities in which the technical advice and guidance is being given 2.6 explain the importance of presenting and communicating advice and guidance clearly and accurately 2.7 explain how to plan and prepare for providing technical guidance 2.8 explain the importance of providing up to date, valid and reliable advice and guidance 2.9 explain the approach to be taken when there is a range of options/alternatives when responding to requests for advice and guidance

2.10	explain the methods and techniques involved in providing advice and guidance
2.11	explain how to deal with customer requests for advice and guidance
2.12	explain the internal procedures to be followed when providing advice and guidance
2.13	explain the relevant document that should be completed as part of the advice and guidance process
2.14	explain how to ensure the recipient understands the advice and guidance provided
2.15	explain how to gain feedback from the recipient confirming that the advice and guidance provided has met their requirements
2.16	explain how to review and adjust approaches to the provision of technical guidance, in the light of experience gained
2.17	explain the importance of maintaining, where appropriate individual, customer or company confidentiality
2.18	explain the extent of their own responsibility, and whom they should report to if they have problems that they cannot resolve

Unit 436 Implement Quality Assurance Methods and Procedures

UAN:	**J/505/0949**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 18: Implement quality assurance methods and procedures (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to assure the quality of engineering products and processes, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to investigate quality assurance issues, obtaining all the necessary information to enable them to evaluate the possible solutions and their effects on both the engineering products and the processes involved. They will also be expected to decide and communicate quality assurance recommendations to all relevant people associated with the engineering products or processes. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful assurance of quality, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. Their knowledge of evaluation methods will enable them to assess the effectiveness of the quality assurance principles and systems, whilst ensuring compliance with their company's organisational procedures and systems. They will also be conversant with organisational specifications, details and formats, and resource management principles.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. implement quality assurance methods and procedures
Assessment criteria
The learner can: 1.1 carry out all of the following during the quality assurance activity: a. establish clear criteria as the basis of the quality assurance process b. obtain accurate information from appropriate sources for consideration in the process c. assess and specify the quality requirements for the engineering products or processes d. identify suitable quality assurance methods, techniques and procedures e. assess the implications of implementing the quality assurance procedures f. present recommendations for improvements to the quality assurance process to the appropriate people 1.2 establish clear and precise criteria for assuring the quality of engineering products or processes 1.3 identify suitable quality assurance methods and procedures for four of the following: a. design b. research and development c. product and material specifications d. patents e. quality assurance f. product/component performance checks g. inspection/testing

h. staff training and development plans
i. production methods
j. maintenance and repair
k. installation methods
l. commissioning/decommissioning methods
m. process parameters
n. schedule monitoring
o. contractor performance
p. business improvements
q. purchasing
r. logistics
s. legal requirements
t. the use of appropriate international/national standards
u. company procedures and policy
v. other (to be specified)

1.4 ensure that the specified quality assurance methods and procedures are implemented correctly

1.5 obtain accurate information from valid sources on the engineering product or process being quality assured

1.6 obtain accurate information from five of the following sources:
a. quality assurance department
b. manufacturers' manuals/specifications
c. engineering drawings/models
d. product specifications
e. regulations and guidelines
f. international/national standards
g. legal/patented information
h. company documentation
i. customer specifications

1.7 develop quality assurance procedures that cover two of the following:
a. new product/process
b. revisions to existing product/process
c. legal/legislative requirement
d. international/national standards
e. company standard operating procedures

1.8 specify clearly the required quality of engineering products or processes

1.9 assess accurately and realistically the quality of the engineering products or processes

1.10 ensure that information on quality is provided to the appropriate people

1.11 ensure that the quality assurance methods and procedures comply with four of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.12 recommend improvements to quality to the appropriate people

1.13 report and communicate quality assurance methods and procedures, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to implement quality assurance methods and procedures
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when working on engineering products or processes 2.2 explain the quality criteria that could be used for different types of engineering product or process 2.3 explain the quality assurance methods that are available 2.4 explain the statistical methods for recording and analysing engineering processes 2.5 explain the other non-statistical methods that could be used for obtaining information on engineering products or processes 2.6 explain the relevant sources of valid information on engineering products or processes 2.7 explain who should be involved in the quality assurance process 2.8 explain the type of impact that quality assurance could have on the organisation 2.9 explain who requires information on quality assurance, and the procedures for informing them 2.10 explain how to obtain information on resources 2.11 explain how to determine the resources that are necessary 2.12 explain how to determine the availability and suitability of resources 2.13 explain the regulations, directives and guidelines relevant to their area of responsibility 2.14 explain how to obtain and interpret information on regulations, directives and guidelines 2.15 explain the types of recommendation that could emerge from the quality assurance process 2.16 explain the methods of presenting quality assurance recommendations 2.17 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 437 Improve the Quality of Engineering Products or Processes

UAN:	**A/505/0950**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 19: Improve the quality of engineering products or processes (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to implement quality improvements to engineering products or processes, in accordance with approved procedures. The range of engineering processes could include manufacturing operations, installation, production, maintenance, engineering support functions or other activities, such as performance measurement or business improvement. The learner will be required to plan and implement quality improvements, obtaining all the necessary information to enable them to evaluate and provide solutions to problems, and to assess their effects on both the engineering product and the processes involved. They will also be expected to control resources and to ensure effective implementation of quality improvements. In addition, they will keep all the relevant people associated with the engineering process informed of the quality improvements as they are implemented. The learner's responsibilities will require them to comply with organisational policy and procedures for implementing quality improvements, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as

part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates.

The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems. They will apply quality assurance principles and systems to ensure that the required specifications, details and formats are maintained. They will also know about evaluation methods, resource management and project planning, in adequate depth to provide a sound basis for carrying out the improvements to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. improve the quality of engineering products or processes
Assessment criteria
The learner can: 1.1 carry out all of the following when implementing the quality improvements: a. plan the implementation of quality improvements so as to minimise disruption to normal working b. identify and use suitable quality improvement methods, techniques and procedures c. control the use of resources for the implementation of the quality improvements d. carry out the quality improvements in accordance with the implementation plan e. solve any problems that occur during the implementation f. assess the impact of the improvements on the quality of products or processes 1.2 plan the introduction of improvements to the quality of engineering products or processes 1.3 plan the introduction of quality improvements for one of the following: a. new product/process b. revisions to existing product/process

c. legal/legislative requirement
d. international/national standards requirements
e. company standard operating procedures

1.4 specify clearly the improvements that should be implemented

1.5 specify quality improvements to the product or process, to include three of the following:

a. components
b. equipment
c. materials
d. inspection/testing procedures
e. design
f. research and development
g. maintenance/servicing
h. services
i. business systems
j. safety
k. environmental impact
l. supplier
m. logistics
n. buying
o. technologies
p. product or process flow
q. setting or preparation activities
r. employee related (such as numbers, training, deployment)
s. other (to be specified)

1.6 obtain information to improve quality from five of the following:

a. quality assurance department
b. design department
c. research department
d. manufacturer's specifications
e. product specifications
f. regulations, guidelines or directives
g. international/national standards
h. benchmarking
i. technical experts
j. customer feedback
k. legal/patented information
l. company documentation and records
m. direct observation
n. supplier data and information
o. other (to be specified)

1.7 confirm that conditions are suitable to implement the improvements

1.8 provide clear and accurate instructions to all the relevant people

1.9 control the use of resources to achieve the most effective results

1.10 monitor the use of three of the following resources to ensure effective results:

a. personnel
b. materials
c. facilities

d. utilities
e. equipment
f. finance

1.11 ensure that the improvements are implemented according to plan, recorded and comply with all relevant regulations, directives and guidelines

1.12 identify and solve any implementation problems that occur

1.13 ensure that the quality improvements conform to three of the following:

a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or other international standards or directives

1.14 assess the impact of the improvements on the quality of engineering products or processes

1.15 assess the outcome of the quality improvement implementation, to include two of the following:

a. impact of the improvements on the quality of products or processes
b. cost effectiveness of the process/actions
c. effect of changes to quality assurance methods or procedures
d. quality of data held on the company information system
e. effectiveness of reporting procedures
f. lessons learned

1.16 report and communicate the product/process quality improvements, using:

a. verbal methods

plus one from the following:

b. electronic mail
c. computer generated report
d. specific company form
e. other appropriate media

Learning outcome
The learner will: 2. understand how to improve the quality of engineering products or processes
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the area in which the quality improvements are to be implemented 2.2 explain the importance of wearing protective clothing (ppe) and other appropriate safety equipment during the implementation, and where it may be obtained 2.3 explain how to obtain and interpret drawings, charts, specifications, manufacturers' manuals, history/maintenance reports and other documents needed for the implementation of quality improvements 2.4 explain the engineering processes and operating procedures in the area associated with the quality issues 2.5 explain the types and effects of quality improvement, and their impact 2.6 explain the factors that have to be taken into account when selecting the solution to a quality problem 2.7 explain the techniques used to obtain information 2.8 explain the methods and techniques involved in quality improvement implementation 2.9 explain the methods and techniques involved in evaluating information 2.10 explain how to obtain and interpret legislative and regulatory documentation 2.11 explain how to obtain and interpret company policy and personnel procedures 2.12 explain the organisational reporting procedures and documentation, and their application 2.13 explain who to inform of actions taken, and by what means 2.14 explain how to retrieve the necessary data from company information systems 2.15 explain the types of impact assessment systems/techniques available, and their application 2.16 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 438 Specify Risk Reduction Methods and Procedures

UAN:	**F/505/0948**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from National Occupational Standard Engineering Management Unit No 17: Specify Risk Reduction Methods and Procedures (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to specify methods and procedures for reducing the risks of accidents associated with engineering products and processes within their organisation. The learner will be required to specify the appropriate methods and procedures to carry out a risk reduction activity, and to determine the resources required. In addition, they will be expected to identify and utilise opportunities to promote the further implementation of risk reduction methods. The learner's responsibilities will require them to comply with organisational policy and procedures for risk reduction, and to report any problems that they cannot personally resolve to the relevant authority. They will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. They will be fully conversant with organisational procedures and systems, and will have an understanding of resource management, risk analysis and risk assessment, in sufficient depth to enable

them to carry out their activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. They will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace

Learning outcome
The learner will: 1. specify risk reduction methods and procedures
Assessment criteria
The learner can: 1.1 obtain existing risk analysis information for two of the following engineering activities: a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining) b. design c. research d. product or system installation e. commissioning f. decommissioning or recycling g. environmental or sustainability h. operational processes (such as movement of materials and logistics) i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention) j. processing operations k. service supplies (such as gas, water, electricity) l. engineering support functions (such as procurement, quality assurance, inspection, testing, scheduled safety audits and risk assessments, business improvement) 1.2 obtain accurate details of the risks 1.3 consider the effect and cost of changes or improvements on all of the following: a. materials used b. the operational process c. equipment, equipment systems or related technologies d. personal protective equipment (PPE) e. training and development f. operational instructions/procedures g. workplace environment/sustainability h. health and safety i. work patterns j. system reliability k. quality of products or services

l. logistics
m. marketing/branding
n. employee downtime
o. staff availability
p. other (to be specified)

1.4 select the most effective methods to reduce risks

1.5 identify the resources that are necessary to implement the risk reduction methods

1.6 specify or use three of the following resources necessary to implement risk reduction methods:

a. process or operation expertise
b. additional personnel
c. HSE or similar expert help
d. engineering design/research or similar expertise
e. human resources (HR) personnel department information
f. auditing and monitoring services
g. external expertise
h. regulations, directives and guidance documentation
i. company policy advice
j. other (to be specified)

1.7 identify the activities required to implement the risk reduction methods

1.8 specify clearly the procedures for implementing the risk reduction methods

1.9 ensure that risk reduction methods and procedures comply with three of the following:

a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. health, safety and environmental requirements
d. recognised compliance agency/body's standards, directives or codes of practice
e. customer standards and requirements
f. British, European or International standards or directives

1.10 specify risk reduction methods that take into account all of the following as appropriate:

a. health and safety requirements and appropriate codes of practice
b. the potential for further risks occurring
c. data gathering
d. revised management procedures
e. when to implement risk reduction actions
f. prioritisation and decision making
g. consideration of interim effects on the process
h. recording of risk analysis data
i. other (to be specified)

1.11 utilise opportunities to promote the implementation of the risk reduction methods

1.12 record the risk reduction methods and procedures in the appropriate information systems

1.13 record and communicate the risk reduction methods and procedures to the appropriate people using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. computer-based presentation
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to specify risk reduction methods and procedures
Assessment criteria
The learner can: 2.1 explain how to obtain details of the potential risks, and of any risk analyses previously conducted 2.2 explain the risk reduction methods that could be used 2.3 explain how different types of equipment can be used for different risk reduction methods 2.4 explain the activities that are required for the implementation of risk reduction methods 2.5 explain how to obtain information on the resources required for the risk reduction 2.6 explain how to determine the internal and external resources necessary 2.7 explain how to ensure the availability and suitability of resources 2.8 explain the person or people who will be carrying out the risk reduction procedures 2.9 explain the different ways in which to specify procedures for different groups of people 2.10 explain what to include in the procedures, and the level of detail required 2.11 explain the regulations, directives and guidelines that are relevant to the risk reduction activities 2.12 explain how to obtain and interpret information on regulations, directives and guidelines 2.13 explain the company systems for recording information 2.14 explain the importance of using the appropriate company information systems 2.15 explain the extent of their own authority, and to whom they should report to if they have problems that they cannot resolve

Unit 439 Evaluate Engineering Risk Assessments

UAN:	**A/505/0947**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit 016 Evaluate engineering risk assessments (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to meet the requirements necessary for accident risk analysis and assessment on engineering activities within their organisation. The learner will be responsible for analysing risks, assessing the extent of the risk and for ensuring that all relevant information is communicated and recorded in the appropriate information systems. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful analysis of risks, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of organisational processes and procedures, including risk analysis and assessment. The learner's general and discipline-specific knowledge of engineering principles and processes will allow them to take an informed approach towards analysing the engineering activities, helping to resolve related problems and to make sound decisions.

The learner will be fully aware of any health, safety and environmental requirements applicable to their area of responsibility and will be conversant with legislative and regulatory frameworks. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility them owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. evaluate engineering risk assessments
Assessment criteria
The learner can: 1.1 establish clear criteria for the evaluation activity 1.2 plan the most appropriate method for evaluating risk assessments 1.3 confirm the completed risk assessments are current, valid and reliable 1.4 evaluate risk assessment activities for one of the following: a. manufacturing (such as machining, fabrication, welding, material finishing or manufacture, assembly, joining) b. design c. research d. product or system installation e. commissioning f. decommissioning or recycling g. environmental or sustainability h. operational processes (such as movement of materials and logistics) i. maintenance practices (such as preventative, corrective, predictive, reactive or prevention) j. processing operations k. service supplies (such as gas, water, electricity) l. engineering support functions (such as procurement, quality assurance, inspection, testing, scheduled safety audits and risk assessments, business improvement) 1.5 ensure that any relevant regulations, directives or guidelines relating to the risks have been identified 1.6 evaluate the potential risks by considering the impact on three of the following: a. personnel b. equipment c. property/assets d. quality e. environment f. impact on the business (such as finance, branding, market) g. other (to be specified) 1.7 evaluate and rank the potential impact of the risks identified 1.8 recommend appropriate actions that includes three of the

following:

a. a risk reduction process
b. allowing a period of time before re-analysis
c. implementing a special monitoring processes
d. continuing (such as the risk ranking result is acceptable)
e. suspending operation and rectifying immediately
f. implementing interim containment action

1.9 ensure that the evaluation outcomes of the risks are communicated to the appropriate people

1.10 monitor and review the effectiveness of the risk assessment process

1.11 make amendments to the process where improvements have been identified

1.12 record the evaluation or risk assessments in the appropriate systems

1.13 record the risk information and include references to six of the following:

a. the company health and safety policy
b. accident and or 'near miss' reports
c. identification of regulations and or guidelines
d. the method of assessing and ranking the risk
e. predictable and preventable risks
f. a description of the risk(s) and their ranking
g. the implication of a risk occurring
h. general management organisation
i. frequency and duration of exposure to the risk
j. analysis, decisions and recommendations

Learning outcome
The learner will: 2. understand how to evaluate engineering risk assessments
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be observed when carrying out a risk analysis 2.2 explain the organisational engineering activities where risk analysis is deemed to be necessary 2.3 explain the process-related attributes from which risks could occur 2.4 explain the types of risk that can arise from different engineering activities 2.5 explain the factors that could relate to the risks 2.6 explain how to obtain information on the risk factors 2.7 explain the types of risk analysis and evaluation methods that are appropriate to different types of risk 2.8 explain the type of supporting information and documentation that is required 2.9 explain the amount of supporting information that should be provided 2.10 explain who is affected by the risks 2.11 explain who requires information on the risks 2.12 explain the potential implications of the risks 2.13 explain the regulations, directives and guidelines that are relevant to the areas being analysed 2.14 explain how to obtain and interpret information on regulations, directives and guidelines 2.15 explain the various company systems for recording risks and risk-related issues 2.16 explain the importance of using the appropriate company information systems 2.17 explain the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 440 Investigate Incidents Relating to Engineering Activities

UAN:	**K/505/0961**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 30 Investigate incidents relating to engineering activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out an investigation of incidents relating to engineering activities, in accordance with approved procedures. The learner will be required to obtain evidence and information, to identify the potential cause(s), and to recommend improvements to the affected engineering activities. The learner will also be expected to communicate the outcome of the investigation, in the most appropriate manner, to the relevant people. The learner's responsibilities will require them to comply with organisational policy and procedures for investigating incidents, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will be fully conversant with organisational procedures and systems. The learner will have a

substantial knowledge of risk analysis and assessment and, in particular, the techniques and procedures for investigating and reporting accidents or `near misses'. This knowledge will allow them to take an informed approach to carrying out such investigations, to resolve related problems and to make sound decisions.

The learner will be familiar with various presentation and communication methods, and will know how to choose the appropriate ones to use for different target audiences.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. investigate incidents relating to engineering activities
Assessment criteria
The learner can: 1.1 investigate incidents related to three of the following engineering activities: a. production activities (such as processing materials, fabrication, finishing, assembly, joining) b. installation activities (such as commissioning/decommissioning, site preparation, equipment installation) c. operational activities (such as movement of materials, quality systems and audit, scheduled safety audits and risk assessments) d. maintenance activities (such as planned preventive maintenance (PPM), part or sub-assembly exchange, breakdown response maintenance records systems, line setting) e. design and research 1.2 plan the most appropriate way for investigating the incident 1.3 produce an investigation plan that includes all of the following: a. the (possible) severity of an injury b. who will carry out the investigation c. the damage to equipment d. estimated cost of the investigation e. potential business loss f. ethical considerations g. community (public) opinion

h. the nature of the incident potential
i. employee concerns
j. involvement of emergency services
k. mandatory responsibilities
l. staff representation
m. breach of health and safety
n. the immediate process effect
o. legal implications
p. equipment supplier (such as responsibilities, implications)

1.4 review all of the following information during an investigation:
a. health and safety standards
b. extent of any injuries and their affects
c. events leading up to and associated with the incident
d. post incident risk prevention recommendations
e. foreseeable and preventative incident risk conjecture
f. actual and potential effect of an incident
g. actual immediate incident management
h. improvements to the engineering activity
i. responsibilities
j. equipment damage
k. contributory factors
l. business cost
m. time lost
n. role of the emergency services
o. the (likely) cause(s)

1.5 obtain sufficient relevant and accurate information from valid sources relating to the incident

1.6 gather and evaluate information using five of the following sources:
a. cctv or photographic evidence
b. personnel records
c. material or substance data sheets
d. legislative information
e. health and safety executive accident statistics
f. re-enactment
g. shift reports
h. site history of incidents and `near misses'
i. incident reports
j. dangerous occurrence reports
k. maintenance history
l. process change records
m. operational procedures
n. drawings or diagrams
o. equipment detail
p. expert statements
q. witness statements

1.7 identify the potential causes of the incident

1.8 consider all of the following when investigating the possible cause of the incident:
a. workplace environment (such as housekeeping, activities, products and materials)

b. management quality (such as supervision, policy, discipline)
c. work hours (such as overtime, shift patterns)
d. nature of the incident (such as an explosion, gas discharge or hot metal discharge)
e. equipment (such as ergonomics, malfunction or a safety function failure)
f. skill levels (such as competence, instruction, training)
g. human related (such as deliberate misconduct, sabotage, error of judgement or fatigue)
h. other (to be specified)

1.9 evaluate all relevant information relating to the incident

1.10 specify the contributory factors that led to the incident

1.11 consider all of the following when identifying contributory factors that led to the incident:

a. care and welfare of employees
b. maintenance
c. discipline
d. general conditions and facilities
e. level of supervision
f. work demands
g. skills, experience and knowledge
h. housekeeping
i. stress
j. use of direct or indirect labour
k. morale
l. provisions and aids

1.12 provide clear and justifiable conclusions on the causes of the incident

1.13 recommend improvements to the engineering product or process associated with the incident

1.14 record and present the results of the investigation to the appropriate people

1.15 record and communicate the results of the investigation to the appropriate people, using:

a. a verbal report plus one from the following:
b. electronic mail
c. computer-based presentation
d. computer generated report
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to investigate incidents relating to engineering activities
Assessment criteria
The learner can: 2.1 explain the engineering activities within their organisation where incidents could occur 2.2 explain the types of incident that could occur 2.3 explain the factors that should be taken into account when planning an investigation 2.4 explain how to prepare an investigation plan, and the appropriate company format to use 2.5 explain the methods that could be used for obtaining information on an incident 2.6 explain the valid and relevant sources if information to use when investigating incidents 2.7 explain the amount of information that should be collected 2.8 explain the methods that are available for evaluating information on incidents 2.9 explain the potential contributory factors to consider when determining the cause of incidents 2.10 explain how to assess the impact of each of the different contributory factors 2.11 explain the importance of providing clear and justifiable conclusions on the causes of an incident 2.12 explain the type and amount of evidence necessary to support their conclusions 2.13 explain the type of impact the investigation could have on the organisation 2.14 explain who requires the information, and the procedures for informing them 2.15 explain how to instigate training, special instructions or procedures as a result of incident investigations 2.16 explain the types of recommendation that could emerge from an investigation 2.17 explain methods for error proofing or mistake proofing (such as poke yoke) 2.18 explain how to present their recommendations 2.19 explain the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 441 Configure Engineering Products, Processes or Facilities

UAN:	**H/505/0957**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 26 Configure engineering products, processes or facilities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to configure engineering products, processes or facilities, in accordance with approved procedures. This will involve liaising with customers to ensure that the configuration meets with their requirements. The learner will be responsible for planning and obtaining resources, monitoring that specifications are achieved, and evaluating, recording and communicating the results of the configuring process. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful configuration of engineering products, processes or facilities, and to report any problems that they cannot personally resolve, to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will also be fully

conversant with organisational procedures and systems, and will have a good understanding of the principles and processes of configuration. The learner will also understand problem solving methods and resource management techniques, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace..

Learning outcome
The learner will: 1. configure engineering products, processes or facilities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety, environmental and other relevant regulations, directives and guidelines 1.2 carry out all of the following during the configuring process: a. identify the customer's requirements for the configuration b. plan the most appropriate way to carry out the configuring c. determine and obtain suitable resources d. ensure and verify that the configuring process achieves the client requirements e. confirm that the configuring complies with relevant regulations, directives and guidelines f. record and communicate information on the configuring to appropriate people 1.3 consult with the customer to determine the configuring requirements for two of the following: a. production line b. process or flow line c. specification change d. process change e. equipment f. tooling g. product/system change h. storage i. software/hardware j. add or remove operations k. manufacturer agreed modifications l. other (to be specified)

1.4 establish a plan to achieve three of the following customer requirements:
   a. timing plan
   b. preparation of product, system or equipment
   c. identification of authorisation channels
   d. preparation of process
   e. environmental requirements
   f. testing and/or trials
   g. configuring process
   h. handover process

1.5 determine and obtain three of the following resources:
   a. equipment
   b. plant
   c. personnel
   d. facilities
   e. components
   f. services
   g. finance
   h. materials
   i. other (to be specified)

1.6 follow all relevant setting-up and operating specifications for the product or asset being configured

1.7 follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved

1.8 ensure that the configuration complies with three of the following:
   a. organisational guidelines and procedures
   b. recognised compliance agency/body's standards, directives or codes of practice
   c. equipment manufacturer's operating specification/range
   d. customer standards and requirements
   e. health, safety and environmental requirements
   f. British, European or International standards or directives

1.9 monitor the configuration process to ensure that all of the following are achieved:
   a. correct implementation, to the agreed plan
   b. effective use of resources
   c. identification and solving of any problems that occur

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

1.11 check that the configuration is complete and that the equipment operates to specification

1.12 complete all relevant documentation accurately and legibly

1.13 record and communicate details of the configuration process to the appropriate people, using:
   a. a verbal report

   plus one of the following
   b. electronic mail
   c. computer-based presentation
   d. computer generated report
   e. specific company document
   f. other appropriate media

Learning outcome
The learner will: 2. understand how to configure engineering products, processes or facilities
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the configuring activities, location and product/process/facility being configured 2.2 explain the specific safety precautions to be taken when configuring engineering products, processes or facilities 2.3 explain how to obtain details of which engineering products, processes or facilities require configuration 2.4 explain the types of configuration methods applicable to different types of engineering products, processes or facilities 2.5 explain how to obtain information on customer requirements 2.6 explain engineering principles appropriate to the configuring of engineering products, processes or facilities 2.7 explain the types of problem that could occur with the configuration, and how to solve them 2.8 explain how to obtain information on resources 2.9 explain how to determine the resources necessary for the configuration process 2.10 explain how to determine the availability and suitability of resources 2.11 explain the regulations, directives and guidelines that are applicable to the configuration activity 2.12 explain how to obtain and interpret information on regulations, directives and guidelines 2.13 explain the specifications and expected outcomes from the engineering products, processes or facilities being configured, and how to evaluate whether they are being achieved 2.14 explain evaluation techniques for confirming that the configuring process is being carried out correctly 2.15 explain the company systems for recording and communicating information 2.16 explain the importance of using the company information systems 2.17 explain the most appropriate ways of communicating the results of the configuration (to the customer and others) 2.18 explain the extent of their own responsibility and to whom they should report if they have issues that they cannot resolve

Unit 442 Transfer Control of Engineering Products, Processes or Facilities

UAN:	**K/505/0958**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 27 Transfer control of engineering products, processes or facilities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to transfer control of engineering products, processes or facilities, in accordance with approved procedures. This will include communicating with all personnel involved with or affected by the change of control. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful transfer of control of engineering products, processes or facilities, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will also be fully conversant with organisational procedures and systems, and will know about the specifications, details and formats, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. transfer control of engineering products, processes or facilities
Assessment criteria
The learner can: 1.1 confirm the procedures for transferring control of the engineering product or process 1.2 carry out all of the following during the transfer of control: a. identify the specifications and requirements that apply b. identify the personnel involved, and ensure that they have the appropriate information c. plan the transfer of control to minimise disruption to normal working d. prepare the products, processes or facilities for transfer e. transfer control, in accordance with the appropriate procedures f. verify that the transfer has been successful, and that the products, processes or facilities meet the requirements of the customer g. confirm that all relevant specifications, regulations, directives and guidelines have been complied with h. document and communicate the appropriate information to all relevant personnel 1.3 ensure that the engineering product or process is ready for transfer and complies with all relevant specifications and requirements 1.4 determine all of the following requirements for transferring control: a. the product, process or facility description b. the personnel from whom control is being transferred c. any specific requirements d. the personnel to whom control is to be transferred 1.5 establish plans to transfer control that includes two of the following: a. timing plan b. preparation of product, process or facility c. identification of authorisation channels d. testing and/or trials e. safety and environmental requirements f. handover 1.6 ensure that the transfer of control complies with three of the following:

a. organisational guidelines and procedures
b. recognised compliance agency/body's standards, directives or codes of practice
c. equipment manufacturer's operating specification/range
d. customer standards and requirements
e. health, safety and environmental requirements
f. British, European or International standards or directives

1.7 provide clear and accurate information to the relevant personnel on the engineering product or process

1.8 identify and explain any aspects of the engineering product or process that vary from the agreed specifications and requirements

1.9 carry out one of the following actions during a transfer of control:
a. change the specification
b. seek authority to proceed without compliance with the specification
c. change the product or process

1.10 obtain acceptance of the engineering product or process according to the agreed transfer procedures

1.11 transfer control and obtain acceptance for all of the following:
a. confirmation of the agreed specification and procedures
b. confirmation that products, processes or facilities comply with specifications and requirements
c. details of any variation from, or non-compliance with, the agreed specifications and requirements

1.12 ensure that all relevant documentation is correctly completed and recorded in the appropriate information systems

1.13 record and communicate the transfer of control to the appropriate people, using:
a. a verbal report

plus one from the following:
b. electronic mail
c. computer-based presentation
d. computer generated report
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to transfer control of engineering products, processes or facilities
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the control transferring activities, and how they apply to the product, process or facility being transferred 2.2 explain the relevant regulations, directives and guidelines applicable to transferring of control of engineering processes 2.3 explain how to obtain information on regulations, directives and guidelines 2.4 explain how to define the key factors for the product, process or facility that might be affected by the transfer of control 2.5 explain how to liaise with customers to determine their requirements for transferring control 2.6 explain who to communicate with customers regarding the transfer of control 2.7 explain the procedures for transferring control for products, processes or facilities 2.8 explain the techniques for assessing and dealing with aspects of the products, processes or facility, that may not comply with specifications or requirements 2.9 explain the specifications and expected outcomes from the engineering products, processes or facility, and how to evaluate whether these are being achieved at the time of the transfer of control 2.10 explain the organisational systems for recording information 2.11 explain the importance of using company information systems 2.12 explain the various and most appropriate ways of achieving acceptance of the process from the receiving person or organisation 2.13 explain the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 443 Propose Decommissioning of Engineering Equipment, Processes or Facilities

UAN:	**M/505/0959**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 28 Propose decommissioning of engineering equipment, processes or facilities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to propose engineering equipment, processes or facilities for decommissioning, in accordance with approved procedures. The learner will be required to prepare proposals for the decommissioning, including assessing which equipment, processes or facilities should be decommissioned, ensuring that the proposed decommissioning complies with all regulations, directives, guidelines, company policies and procedures, and preparing and presenting their recommendations to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful preparation of decommissioning proposals, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general

and discipline-specific engineering principles and processes. The learner will also be fully conversant with organisational procedures and systems. The learner will understand the decommissioning process, maintenance principles and processes, and the specifications, details and formats of the items to be decommissioned, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace..

Learning outcome
The learner will: 1. propose decommissioning of engineering equipment, processes or facilities
Assessment criteria
The learner can: 1.1 carry out all of the following activities when proposing equipment, processes or facilities for decommissioning: a. select a process, facility or item of equipment for potential decommissioning b. determine the extent of the decommissioning (partial or complete) c. gather all relevant information on the equipment, process or facility that they propose to decommission d. determine the decommissioning requirements of the equipment, process or facility e. ensure that proposed decommissioning methods and procedures meet relevant regulation, directives and guidelines f. present the decommissioning proposal with full justification and assessment of alternatives 1.2 assess the effectiveness of the engineering products or processes in delivering the required outputs 1.3 assess the effectiveness of products, processes or facilities against all of the following: a. safety b. technology c. process capability d. legislation/regulations e. forecasts/trends f. obsolescence g. financial viability h. viability of services/utilities

i. scrap levels
j. environmental impact
k. quality performance
l. other (to be specified)

1.4 identify the options for decommissioning engineering products or processes

1.5 determine the level and extent of the proposed decommissioning from all of the following aspects:
a. shutdown
b. isolation
c. deactivation
d. disposal
e. removal
f. other (to be specified)

1.6 obtain accurate details of the engineering products or processes that could potentially be decommissioned

1.7 review all relevant aspects of the engineering products or processes to assess their decommissioning

1.8 assess the advantages and disadvantages of decommissioning the engineering products or processes

1.9 identify the safety and environmental requirements of the decommissioning process

1.10 establish that the decommissioning complies with all relevant regulations, directives and guidelines

1.11 identify decommissioning requirements from three of the following:
a. organisational guidelines and procedures
b. recognised compliance agency/body's standards, directives or codes of practice
c. equipment manufacturer's operating specification/range
d. customer standards and requirements
e. health, safety and environmental requirements
f. British, European or International standards

1.12 recommend engineering products or processes for decommissioning

1.13 recommend two of the following for decommissioning:
a. assets
b. services
c. equipment
d. systems
e. production processes
f. installations
g. facilities

1.14 prepare a proposal for decommissioning that includes all of the following:
a. recommendations for decommissioning
b. reason/justification for the selection
c. details of options
d. advantages and disadvantages of the various options
e. cost implications
f. timing considerations
g. environmental considerations

h. regulations, directives and guidelines involved

1.15 record and communicate proposals for decommissioning to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer-based presentation
d. computer generated report
e. specific company document
f. other appropriate media

Learning outcome
The learner will: 2. understand how to propose decommissioning of engineering equipment, processes or facilities
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the proposed decommissioning 2.2 explain how to obtain details of what engineering equipment, processes or facilities are not performing to the required standards 2.3 explain the methods and techniques involved in assessing which equipment, processes or facilities should be decommissioned 2.4 explain the different levels of decommissioning that could be applied 2.5 explain how to obtain details about the equipment, process or facility proposed for decommissioning 2.6 explain the advantages and disadvantages of decommissioning a particular process, facility or item of equipment 2.7 explain how to obtain and interpret the relevant legislative and regulatory documentation 2.8 explain how to obtain and interpret company policy 2.9 explain how to prepare a proposal for decommissioning, and the appropriate format to use 2.10 explain how to present reports and recommendations 2.11 explain the company reporting procedures, documentation and their application 2.12 explain whom to inform of the proposal(s), and by what means 2.13 explain the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 444 Plan and Decommission Engineering Equipment, Processes or Facilities

UAN:	**H/505/0960**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 29 Plan and decommission engineering equipment, processes or facilities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to plan and decommission engineering equipment, processes or facilities, in accordance with approved procedures. This will include confirming the decommissioning requirements with clients, planning and obtaining resources, and defining and working to timescales. The learner will also be required to monitor and verify that the decommissioning requirements have been achieved. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful decommissioning of engineering equipment, processes or facilities, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will provide a good understanding of general and discipline-specific engineering principles and processes. The learner will be fully conversant with organisational procedures

and systems for decommissioning. The learner will understand the decommissioning process, maintenance principles and processes, and resource management, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and also the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. plan and decommission engineering equipment, processes or facilities
Assessment criteria
The learner can: 1.1 carry out all of the following during the decommissioning process: a. identify the equipment, processes or facilities to be decommissioned b. plan the decommissioning process to minimise disruption to normal working c. identify the necessary resources and timescales for the decommissioning d. anticipate potential problems and produce appropriate contingency plans e. confirm that the conditions are suitable for the decommissioning to proceed f. carry out the decommissioning in accordance with regulations and guidelines g. confirm that the completed decommissioning has met all the requirements 1.2 identify and confirm that all of the following conditions are met for the decommissioning: a. authorisation b. preparation of site c. availability of resources d. compliance with regulations, directives and guidelines e. preparation of products or processes f. environmental 1.3 plan the most appropriate way to decommission the engineering product or process 1.4 identify potential decommissioning problems and produce appropriate contingency plans 1.5 identify potential decommissioning problems and produce appropriate contingency plans 1.6 specify appropriate methods and procedures to be used in the

decommissioning of all of the following:

a. isolation from services (such as gas, electricity, water, air)
b. safe handling and disposal of dangerous substances or items
c. shutdown or deactivation of the equipment, process or facility
d. safe handling and disposal of waste or scrap
e. safety checks prior to and after decommissioning (such as to verify isolation, discharge stored energy, minimise hazards)
f. relocation of re-usable items or materials
g. restoration of services to the area (as appropriate)
h. dismantling or decommissioning

1.7 confirm that conditions are suitable to implement the decommissioning methods and procedures

1.8 calculate the resources and timescales required to implement the decommissioning

1.9 identify the decommissioning timescales that will be required, and three of the following resources:

a. equipment
b. materials
c. personnel
d. facilities
e. finance

1.10 control the use of resources to achieve the most effective results

1.11 ensure that the decommissioning is implemented according to plan and complies with all relevant regulations, directives and guidelines

1.12 ensure that the decommissioning complies with three of the following:

a. organisational guidelines and procedures
b. recognised compliance agency/body's standards, directives or codes of practice
c. equipment manufacturer's operating specification/range
d. customer standards and requirements
e. health, safety and environmental requirements
f. British, European or International standards or directives

1.13 implement the decommissioning process using all of the following:

a. maintaining efficient use of resources
b. monitoring the process against the decommissioning plan
c. identifying and solving problems as they occur

1.14 identify and solve any decommissioning problems that occur

1.15 verify the decommissioned status of the engineering product or process

1.16 assess the results of the decommissioning on the remaining engineering products or processes

1.17 record and communicate the decommissioning process to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer-based presentation
d. written or typed report
e. specific company document

Learning outcome
The learner will: 2. understand how to plan and decommission engineering equipment, processes or facilities
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements applicable to the decommissioning activities, the location and the equipment, process or facility being decommissioned 2.2 explain how to obtain details of the decommissioning proposal 2.3 explain the factors that could affect plans for decommissioning 2.4 explain the types of decommissioning problems that could occur, and how to solve them 2.5 explain how to prepare contingency plans for any anticipated problems 2.6 explain the alternative decommissioning practices that could be used for different engineering equipment, processes or facilities 2.7 explain how to verify that the decommissioning activity has been completed 2.8 explain the affect and impact the decommissioning could have on other engineering equipment, processes or facilities 2.9 explain the range of conditions that should be considered before undertaking the decommissioning 2.10 explain how to obtain information on resources 2.11 explain how to determine the resources necessary 2.12 explain how to ensure that the necessary resources are available and suitable 2.13 explain the regulations, directives and guidelines that are applicable to the decommissioning activity 2.14 explain how to obtain and interpret information on regulations, directives and guidelines 2.15 explain the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

Unit 445 Commission Engineering Products, Processes or Facilities

UAN:	**M/505/0962**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 31 Commission engineering products, processes or facilities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to commission engineering products, processes or facilities, in accordance with approved procedures. The learner will be required to apply appropriate methods and procedures to the commissioning activity. This will include liaising with customers to determine the relevant specifications, scheduling and obtaining resources, ensuring compliance with all regulations, directives and guidelines, ensuring that requirements are achieved, and evaluating, recording and communicating the results of the commissioning process to the appropriate people. The learner's responsibilities will require them to comply with organisational policy and procedures for ensuring the successful commissioning of engineering products and processes, and to report any problems that they cannot personally resolve to the relevant authority. The learner will be expected to work unsupervised, either on their own or as part of a team, which they may lead or direct, taking full responsibility for their actions, and possibly for the work of colleagues or subordinates. The learner's underpinning knowledge will

provide a good understanding of general and discipline-specific engineering principles and processes. The learner will be fully conversant with organisational procedures and systems. The learner will understand the commissioning process, product and service configurations, and installation principles and processes. The learner will also know about evaluation methods and resource management techniques, in adequate depth to provide a sound basis for carrying out the activities to the required standard.

The learner will be fully aware of any health, safety and environmental requirements, and the appropriate legislative and regulatory frameworks applicable to their area of responsibility. The learner will be required to ensure that safe working practices are maintained throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. commission engineering products, processes or facilities
Assessment criteria
The learner can: 1.1 carry out all of the following during the commissioning process: a. identify products, processes or facilities to be commissioned b. clarify the commissioning requirements with the customer c. plan the commissioning to minimise disruption to others d. ensure that the commissioning complies with specifications, regulations and guidelines e. identify and obtain the necessary resources f. implement and monitor the commissioning process g. communicate appropriate information to all relevant people 1.2 establish four of the following during commissioning: a. timing plan b. preparation of products c. authorisation channels d. preparation of site e. environmental requirements f. testing and/or trials g. configuration process h. handover 1.3 specify the methods and procedures for commissioning the engineering product or process 1.4 plan the most appropriate way to commission the engineering product or process 1.5 confirm that conditions are suitable to implement the commissioning

1.6 confirm that conditions are suitable to implement the commissioning process, including all of the following:
   a. the implementation plan for the commissioning activity is agreed and authorised
   b. appropriate resources are available
   c. contingency plans are in place to deal with problems as they occur
   d. outputs of the commissioning process have been identified for the subsequent handover report

1.7 determine and obtain the resources required to undertake the commissioning

1.8 obtain appropriate resources, including two of the following:
   a. equipment
   b. materials
   c. personnel
   d. facilities
   e. plant equipment
   f. services
   g. finance
   h. other specific resources

1.9 ensure that the commissioning is implemented correctly

1.10 identify and solve any commissioning problems

1.11 assess the results of the commissioning to identify the outputs of the engineering product or process

1.12 confirm that the engineering product or process meets specifications and complies with all relevant regulations, directives and guidelines

1.13 ensure that the commissioning meets specifications for all of the following:
   a. functions
   b. materials used
   c. performance
   d. environmental
   e. aesthetics

1.14 ensure that the commissioning complies with three of the following:
   a. organisational guidelines and procedures
   b. recognised compliance agency/body's standards, directives or codes of practice
   c. equipment manufacturer's operating specification/range
   d. customer standards and requirements
   e. health, safety and environmental requirements
   f. British, European or International standards or directives

1.15 communicate with two of the following during the commissioning process:
   a. customer
   b. management
   c. suppliers
   d. sub contractors
   e. colleagues
   f. other (to be specified)

1.16 ensure that the results of the commissioning are recorded in the

appropriate information systems

1.17 record and communicate the results of the commissioning process to the appropriate people, using:

a. a verbal report

plus one from the following:

b. electronic mail
c. computer generated report
d. specific company document
e. commissioning hand over documentation

Learning outcome

The learner will:

2. understand how to commission engineering products, processes or facilities

Assessment criteria

The learner can:

2.1 explain the health, safety and environmental requirements applicable to the commissioning activities, location and product/process/facility being commissioned

2.2 explain how to obtain details of which engineering products, processes or facilities require commissioning

2.3 explain the commissioning methods and procedures to be used, and whom to consult with in the planning process

2.4 explain the alternative commissioning practices that could be used for different engineering products, processes or facilities

2.5 explain the factors that should be taken into account when planning the commissioning

2.6 explain range of conditions that could be encountered, and potential effects on the commissioning process

2.7 explain how to ensure that the commissioning is being implemented correctly

2.8 explain the types of problem that could occur, and how to solve them

2.9 explain the specifications and expected outputs from the engineering products, processes or facilities being commissioned, and how to evaluate that they are being achieved

2.10 explain the assessment techniques for confirming that the commissioning process is being carried out correctly

2.11 explain how to obtain information on resources

2.12 explain how to determine what resources are necessary

2.13 explain how to determine the availability of resources

2.14 explain the relevant regulations, directives and guidelines applicable to their area of responsibility

2.15 explain how to obtain and interpret information on regulations, directives and guidelines

2.16 explain how to assess the results of the commissioning process

2.17 explain the company information and recording systems available

2.18 explain the importance of using the appropriate company information and recording systems

2.19 explain the extent of their own responsibility and to whom they should report if they have issues that they cannot resolve

Unit 446 Determine Welding and Related Technical Requirements to Achieve Objectives

UAN:	**D/505/0987**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 60: Determining Welding and Related Technical Requirements to Achieve Objectives.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to determine welding and related technical requirements, in accordance with approved procedures. The learner will be required to identify the overall activity for which the technical requirements need to be determined, and to gather all appropriate data in order to fulfil the specified objectives. The technical requirements must relate to significant welding and related processes or activities that consist of multiple operations or stages. The learner's responsibilities will require them to comply with organisational policy and procedures for determining and specifying the technical requirements. The learner will report any problems that they cannot personally resolve, or that are outside their personal authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to gathering,

determining and specifying technical requirements for welding and related activities. The learner will understand the welding and related processes within their area of responsibility, including problem solving principles and procedures, in adequate depth to provide a sound basis for carrying out their activities to the required standard. Additionally, they will understand their organisation's methods of operation in sufficient detail to enable them to make informed decisions.

The learner will be aware of any health, safety and environmental requirements applicable to their area of responsibility. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. determine welding and related technical requirements to achieve objectives
Assessment criteria
The learner can: 1.1 clearly identify and confirm the objectives to be achieved 1.2 gather and combine up-to-date information on specified objectives covering all of the following: a. product quality b. timescale c. health, safety and environmental requirements 1.3 assess the work circumstances and their technical implications 1.4 obtain information on the welding and/or related activities, using four of the following sources: a. parent material certificates b. consumables certificates c. specifications for work d. plans and/or schedules e. welding procedures f. welders' qualification(s) g. observation of work conditions h. drawings 1.5 identify technical requirements that could deliver the specified objectives 1.6 take into account all of the following when determining the technical requirements: a. preparation of materials to be welded b. flow of materials to be welded c. preparation of welding equipment and consumables d. welding equipment capability studies

e. welding operation
f. heat treatment (pre- or post-welding) if required
g. inspection requirements
h. health and safety requirements
i. disposal of waste

1.7 identify technical requirements, including six of the following:
a. methods, work instructions or procedures
b. materials/component/equipment supply
c. consumables supply
d. quality control of processes, procedures and materials
e. necessity, or otherwise of preparation of 'mock-ups'
f. training required
g. location of components and/or equipment
h. resources required
i. specialist equipment required
j. qualified welders

1.8 ensure that the technical requirements take account of all of the following working conditions:
a. availability of resources (such as people, materials, equipment, facilities, utilities)
b. availability of support facilities (such as craneage, testing, heat treatment)
c. environmental and safety conditions (such as heating, lighting, hazardous materials, safety equipment, accessibility)

1.9 select and specify for implementation the most appropriate technical requirements to achieve the objectives

1.10 identify and report those requirements which cannot be achieved

1.11 communicate and confirm the technical requirements and any associated problems with the appropriate people using two of the following methods:
a. written or typed report
b. electronically
c. verbally
d. specific company form

Learning outcome
The learner will: 2. understand how to determine welding and related technical requirements to achieve objectives
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when working in a welding and related environment (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop and site safety practice, risk assessment procedures and relevant requirements of HASAWA, COSHH and work equipment regulations) 2.2 explain the personal protective clothing and equipment that should be worn (such as eye protection, ear and head protection) 2.3 explain the hazards associated with working in a welding environment (such as electric arc flashes; fumes and gases; hot metal; grinding and mechanical metal/slag removal), and explain how they can be minimised 2.4 explain the welding processes being used, and their technology (such as basic principles of fusion welding, ac and dc power sources, power ranges, manual metal arc (MMA), MIG, mag or cored-wire arc welding, tungsten arc welding (TIG), submerged arc, gas and plasma welding, electron beam, resistance welding, laser and friction welding and other relevant fusion welding processes) 2.5 explain how the various materials behave during welding (such as structure and property of metals; heat treatment requirements; types of steel and cracking phenomena, cast iron, copper, nickel, stainless steel, aluminium and their alloys; joining dissimilar materials) 2.6 explain the construction and design of welded joints (such as design principles of welded construction, joint design, behaviour of welded structures under static and dynamic loading) 2.7 explain the general principles of welding components and structures (such as use of jigs, fixtures and manipulating devices; residual stresses and distortion; types of defect and their avoidance; quality control during manufacture) 2.8 explain the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality) 2.9 explain how to obtain the required information on welding and related activities, and the types of information that will be available 2.10 explain how to access and use the appropriate information and documentation systems, and their organisation's regulations, guidelines and procedures 2.11 explain how to extract the information required from drawings and welding procedure specifications (such as interpretation of welding symbols; scope, content and application of the welding procedure specification) to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken 2.12 explain the codes and conventions that are used in the welding specifications

2.13	explain the factors to be taken into account when determining the welding technical requirements, especially those relating to health and safety and working conditions
2.14	explain the types of data that should be included in the technical information
2.15	explain the types of resource that are associated with the different types of welding and related activities
2.16	explain the importance of maintaining records of the technical requirements; what needs to be recorded, and where records are kept
2.17	explain who needs to be informed about the welding technical requirements
2.18	explain the organisational procedures for providing information to different people, and the various ways of presenting this information
2.19	explain the importance of providing the right information at the right time
2.20	explain the types of problem that can occur when identifying the welding technical requirements and how to avoid them
2.21	explain the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 447 Plan Welding Production Resources and Activities

UAN:	**H/505/0988**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 61: Planning Welding Production Resources and Activities.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to plan welding production resources and activities, in accordance with approved procedures. The learner will need to produce plans for significant welding and related activities requiring multiple stages in their execution, and this will cover such things as welding production trials and operations, welding equipment changeover and replacement, welding equipment installation and commissioning, welding equipment maintenance, lifting and moving large components and assemblies, welding equipment capability studies or equipment replacement programs, and checking and testing completed welds. The learner will also be required to establish the activities that must be carried out, and the methods and resources to be used, and they will be expected to produce a detailed plan of operation. The learner will be required to complete the work within agreed timescales, whilst ensuring that the activities within their control conform to organisational and legal requirements. The learner's responsibilities will require them to comply with organisational policy and procedures for planning the welding and related activities. The learner will report any problems with the activities that they cannot personally resolve, or that are outside their

personal authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate techniques and procedures for the planning of welding and related activities. The learner will understand the welding activities within their area of responsibility, their technology and application, in adequate depth to provide a sound basis for carrying out the planning process to the required standard. The learner will understand their organisation's methods of operation in sufficient detail to enable them to make informed decisions.

The learner will be aware of any health, safety and environmental requirements applicable to their area of responsibility. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. plan welding production resources and activities
Assessment criteria
The learner can: 1.1 collect the information needed to prepare the plan 1.2 carry out all of the following when determining and producing the welding production plans: a. use the correct issue of company information, including drawings if applicable b. check that all essential information and data needed to produce the plans are available c. collect relevant information on the welding requirements, operations, methods and resources d. determine the availability of resources required e. ensure that health and safety regulations and safe working practices are taken into account f. ensure that the influence of working conditions is recognised and included in the plans g. present the plans in the appropriate formats 1.3 identify health and safety issues and safe working practices and procedures that must be followed 1.4 identify the operations to be carried out and determine their

sequence

1.5 establish which methods are required and what resources are to be used

1.6 prepare plans that include the use of all of the following resources:
   a. people with the necessary skills and qualifications
   b. materials (both raw/parent materials and consumable)
   c. welding equipment (to include welding plant, jig/fixtures)
   d. space
   e. facilities
   f. utilities
   g. ancillary equipment (such as fume extraction, measuring and test equipment)
   h. support services (such as material treatment, NDT testing, lifting and moving equipment)

1.7 identify any special requirements and incorporate them in the plan

1.8 ensure that plans include relevant regulations, standards and guidelines from all of the following, as appropriate:
   a. organisational guidelines and codes of practice
   b. health, safety and environmental requirements
   c. recognised compliance agency/body's standards
   d. customer/client standards and requirements
   e. national and international standards

1.9 estimate timescales required

1.10 prepare and record the plan

1.11 produce welding plans which consider five of the following:
   a. welding production trials
   b. welding production operations
   c. welding equipment changeover and replacement
   d. welding equipment maintenance activities
   e. welding equipment installation and commissioning
   f. welding equipment capability studies
   g. research and development
   h. lifting and moving large components and assemblies
   i. checking and testing of completed welds

1.12 prepare plans that include all of the following:
   a. description of the activities to be carried out
   b. the sequence in which the activities will take place
   c. the documentation to be used (such as drawings, specifications, quality assurance)
   d. the timescales to be met
   e. any special requirements that must be met
   f. details of health and safety issues

1.13 record the plans, using two of the following methods:
   a. specific company documentation
   b. written or typed report
   c. electronic mail
   d. computer based presentation

1.14 inform the appropriate people when the plan is completed

1.15 deal effectively with problems within their control and report those that cannot be solved

Learning outcome
The learner will: 2. understand how to plan welding production resources and activities
Assessment criteria
The learner can: 2.1 explain how to access information on health and safety regulations and guidelines relating to the welding and related activities to be used and plans being produced 2.2 explain the implications of not taking account of legislation, regulations, standards and guidelines when producing the welding plans 2.3 explain the importance of proper planning of the welding activities, and the factors to be taken into account 2.4 explain the welding processes being planned, and their technology (such as basic principles of fusion welding, ac and dc power sources, power ranges, manual metal arc (MMA), MIG, mag or cored-wire arc welding, tungsten arc welding (TIG), submerged arc, gas and plasma welding, electron beam, resistance welding, laser and friction welding and other relevant fusion welding processes) 2.5 explain how the various materials behave during welding (such as structure and property of metals; heat treatment requirements; types of steel and cracking phenomena, cast iron, copper, nickel, stainless steel, aluminium and their alloys; joining dissimilar materials) 2.6 explain the construction and design of the welded joints (such as design principles of welded construction, joint design, behaviour of welded structures under static and dynamic loading) 2.7 explain the general principles of welding components and structures (such as use of jigs, fixtures and manipulating devices; residual stresses and distortion; types of defect and their avoidance; quality control during manufacture) 2.8 explain the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality) 2.9 explain how to obtain information on welding and related activities, and the types of information that will be available 2.10 explain how to access and use the appropriate information and documentation systems, and their organisation's regulations, guidelines and procedures 2.11 explain how to extract the information required from the drawings and welding procedure specifications (such as interpretation of welding symbols; scope, content and application of the welding procedure specification) to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken 2.12 explain the types of data that should be included in the welding plans (such as activities to be carried out, sequence in which they must be carried out, timescales, resource requirements, health and safety issues) 2.13 explain the factors to be taken into account when determining the welding technical requirements, especially those relating to health and safety and working conditions 2.14 explain the types of resource that are associated with the different

types of welding and related activities

2.15 explain the products (or assets) involved in the activity being planned, and their availability

2.16 explain the development of the welding production plans (to include both master documents and working instructions, along with their purpose, content and status)

2.17 explain how to prepare the plans (to include the structure, style, clarity and compliance with relevant standards)

2.18 explain the process used in the organisation to validate the plans produced

2.19 explain the control procedure for ensuring that the plans are maintained and kept up to date

2.20 explain the procedures for changing the plans, and why control procedures are used

2.21 explain the importance of maintaining records of the plans; what needs to be recorded, and where records are kept

2.22 explain who needs to be informed about the welding plans

2.23 explain the organisational procedures for providing information to different people, and the various ways of presenting this information

2.24 explain the importance of providing the right information at the right time

2.25 explain the types of problem that can occur during the implementation of the plan, and explain how these problems can be rectified

2.26 explain the sources of technical expertise if they have problems that they cannot solve

2.27 explain the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 448 Implement Welding Production Methods and Procedures

UAN:	**K/505/0989**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 62: Implementing Welding Production Methods and Procedures.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to implement welding and related production methods and procedures, in accordance with specified requirements. The learner will be required to apply appropriate methods and procedures to ensure that the resources and systems available to them are used effectively and efficiently. The learner will need to ensure that all the conditions and documentation for the required welding production are in place and that correct implementation is achieved. The learner will also be required to identify any opportunities to improve the welding and related production methods during implementation, and to convey this information to the appropriate people and department. The learner's responsibilities will require them to comply with organisational policy and procedures for the implementation of the welding and related production activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to apply their knowledge of welding technology to a range of work activities, performed in a variety of contexts and with a degree of personal

responsibility and autonomy. Responsibility for the work of others and the allocation of resources may also be present.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying welding technology in production. The learner will understand the welding activities within their area of responsibility, their technology and application, in adequate depth to provide a sound basis for carrying out the required implementation to the required specification.

The learner will be aware of any company, legislative or regulatory health, safety and environmental requirements applicable to the welding and related production activity being implemented. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. implement welding production methods and procedures
Assessment criteria
The learner can: 1.1 confirm that conditions are suitable to implement engineering methods and procedures 1.2 ensure that the conditions and relevant documentation are in place for the welding production required, including all of the following: a. welding and related equipment b. human resources c. materials or components d. pre-production preparation of materials or components e. pre-production preparation of the workplace or site f. environmental conditions g. authority to proceed with production h. health and safety conditions i. welder and welding procedure approvals j. quality assurance procedure or quality plans 1.3 implement welding production methods and procedures for two of the following: a. manual b. mechanised c. automatic d. robotic 1.4 implement welding production methods in two processes from one of the following groups:

a. arc welding (MMA, MIG/MAG, TIG, Plasma)
b. solid phase welding (friction, flash, diffusion)
c. resistance welding (spot, seam, projection)
d. brazing, soldering, gas welding

or one process from the following group:

e. high-energy density welding (laser welding or electron beam)

1.5 provide clear and accurate instructions to all the relevant people

1.6 obtain accurate information on the activities being undertaken

1.7 monitor and record welding production methods, using two of the following:

a. observation of the welding production process
b. checking records of the production process
c. producing and maintaining records of the production process
d. consideration and, where appropriate, recommendation of improvements

1.8 ensure that quality assurance systems are correctly implemented

1.9 ensure that engineering support systems are operating correctly

1.10 control the use of resources to achieve the most effective results

1.11 identify opportunities to improve the engineering methods and procedures

1.12 ensure that the implementation of engineering methods and procedures complies with all relevant regulations and guidelines

1.13 consider all of the following, taking account of relevant health and safety requirements, and work in accordance with all those deemed applicable:

a. standards
b. regulations
c. specifications
d. guidelines
e. company procedures

Learning outcome
The learner will: 2. understand how to implement welding production methods and procedures
Assessment criteria
The learner can: 2.1 explain how to access information on health and safety regulations and guidelines relating to the welding production activities to be implemented 2.2 explain the specific safety precautions to be taken when working with welding production and related processes 2.3 explain the implications of not taking account of legislation, regulations, standards and guidelines when implementing the welding production processes 2.4 explain the welding production processes being implemented, and their technology (such as basic principles of fusion welding, ac and dc power sources, power ranges, manual metal arc (MMA), MIG, mag or cored-wire arc welding, tungsten arc welding (TIG), submerged arc, gas and plasma welding, electron beam, resistance welding, laser and friction welding and other relevant fusion welding processes) 2.5 explain how the various materials behave during welding (such as structure and property of metals; heat treatment requirements; types of steel and cracking phenomena, cast iron, copper, nickel, stainless steel, aluminium and their alloys; joining dissimilar materials) 2.6 explain the construction and design of welded joints (such as design principles of welded construction, joint design, behaviour of welded structures under static and dynamic loading) 2.7 explain the general principles of welding components and structures (such as use of jigs, fixtures and manipulating devices; residual stresses and distortion; types of defects and their avoidance; quality control during production) 2.8 explain the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality) 2.9 explain how to obtain information on the welding production requirements, and the types of information available (such as customer requirements and instructions, quality control requirements, product specification, production methods) 2.10 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken) 2.11 explain the types of data that they will require to implement the welding activity (such as activities to be carried out, sequence in which they must be carried out, timescales, resource requirements, health and safety issues) 2.12 explain the production methods that could be used for different types of welding 2.13 explain how to identify conditions that are suitable for the different types of welding production activities 2.14 explain how to obtain details of the welding production activities being undertaken

2.15	explain the factors to be taken into account when implementing the welding production activity, especially those covering working conditions and safety
2.16	explain the main types of resource involved with different types of production welding activities
2.17	explain how to verify that resources are suitable, and available within or to the organisation
2.18	explain the timescales for carrying out the specific production welding activities, and why they must be adhered to
2.19	explain the procedures for making changes in the implementation, to take account of changed circumstances or improvements in the process
2.20	explain the importance of monitoring the production process and maintaining records; what needs to be recorded, and where the records are kept
2.21	explain the quality assurance systems that are being used
2.22	explain the types of problem that can occur during the implementation of the welding production activity, and explain how these problems can be rectified
2.23	explain the extent of their own authority, and explain to whom they should report in the event of problems that they cannot resolve
2.24	explain the sources of technical expertise if they have problems that they cannot solve

Unit 449 Solve Welding Problems in Production

UAN:	**D/505/0990**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 63: Solving Welding Problems in Production.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to solve welding related problems that arise in production, in accordance with approved procedures. The learner will be required to evaluate available evidence, to identify the source of the problem and to recommend/agree solutions, seeking specialist help from others if required. The learner's proposed solution will take into account the effects on both the welding process and on the people involved. The learner's responsibilities will require them to comply with organisational policy and procedures for the welding activities undertaken, and to report any problems with those activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying problem solving techniques and procedures to welding production situations. The learner will understand the relevant welding technology and its application, and will know about the technology in adequate depth to

provide a sound basis for carrying out the activities to the required standard.

The learner will be aware of any company/customer, legislative or regulatory health, safety and environmental requirements applicable to the welding process used. The learner will understand the specific safety precautions required when carrying out the problem solving activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the work area.

Learning outcome
The learner will: 1. solve welding problems in production
Assessment criteria
The learner can: 1.1 take prompt action to solve engineering problems and keep all relevant people informed of progress 1.2 carry out all of the following during the problem solving activity: a. discuss/consult with the relevant people on the nature and extent of the problem and its impact on the welding activity b. gather information from appropriate sources to help identify and define the problem c. Identify and evaluate possible solutions, considering temporary, short term and long term solutions d. select the most appropriate solution to rectify the problem e. communicate the proposed solution to the relevant people, obtaining feedback where appropriate f. prepare a plan of action for implementation of the agreed solution g. ensure that the agreed solution is implemented in an effective and timely manner h. ensure that the agreed solution complies with appropriate regulations and guidelines i. implement preventive measures (where applicable) to ensure that the problem does not reoccur 1.3 resolve two welding production problems from each of the following groups: before welding: a. parent materials b. preparation for welding c. welder qualifications d. welding consumables e. fit-up of joint f. welding and associated equipment

g. welding procedure

during welding:

h. welding equipment performance
i. welder performance
j. quality control
k. weld profile
l. defects
m. distortion
n. low output
o. health and safety

after welding

p. dimensions
q. defects
r. weld properties

1.4 obtain all relevant information relating to the engineering problems

1.5 gather and use all relevant information on welding production problems from six of the following:

a. fabrication drawings
b. material certificates
c. consumables certificates
d. welding records
e. inspection or NDT reports
f. mechanical test reports
g. heat treatment records
h. welding equipment procedures and operation
i. comments from the welder (written or verbal)
j. applicable codes, specifications and procedures
k. welding procedure qualification and welder approval certificate

1.6 identify correctly the nature and extent of any engineering problems that arise

1.7 evaluate all realistic engineering solutions to solve engineering problems

1.8 identify the most effective engineering solution for solving engineering problems

1.9 evaluate possible solutions to the problems, by considering all of the following:

a. operational effectiveness
b. ease of implementation
c. timescale for implementation
d. financial impact
e. functionality of the system
f. environmental impact
g. staffing implications
h. conformity with company policy
i. health and safety implications
j. other specific area

1.10 ensure that engineering solutions are implemented correctly and promptly

1.11 implement the solution for two of the following timescales, taking into account the urgency of the problem:

a. temporary (interim solution – will require further action)
b. medium term (may require further action)
c. long term (permanent solution)

1.12 ensure that solutions to engineering problems comply with all relevant regulations and guidelines

1.13 ensure that the solution complies with relevant regulations, standards and guidelines, from all of the following, as appropriate:
a. statutory bodies
b. company policy and procedures
c. industry specific
d. client requirements
e. manufacturer specific
f. national
g. international

1.14 update the quality assurance system, as appropriate, and communicate the solution of the problem to the relevant people, using the following methods:
a. verbal report

plus one more from the following:
b. specific company documentation
c. written or typed report
d. electronic mail
e. computer based presentation

Learning outcome
The learner will: 2. understand how to solve welding problems in production
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when working with production welding and related equipment (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, risk assessment procedures and relevant requirements of HASAWA, COSHH and work equipment regulations) 2.2 explain the personal protective clothing and equipment that should be worn (such as eye protection, ear protection, safety clothing) 2.3 explain the hazards associated with the production welding and related processes (such as arc flashes, fumes and gases, safety in enclosed/confined spaces, handling hot welded components/structures), and explain how they can be minimised 2.4 explain how to access information on health and safety regulations and guidelines relating to the welding production activities to be implemented 2.5 explain the implications of not taking account of legislation, regulations, standards and guidelines when determining solutions to the welding problems 2.6 explain the welding production processes being used, and their technology (such as basic principles of fusion welding, ac and dc power sources, power ranges, manual metal arc (MMA), MIG, mag

or cored-wire arc welding, tungsten arc welding (TIG), submerged arc, gas and plasma welding, electron beam, resistance welding, laser and friction welding and other relevant fusion welding processes)

2.7 explain how the various materials behave during welding (such as structure and property of metals; heat treatment requirements; types of steel and cracking phenomena, cast iron, copper, nickel, stainless steel, aluminium and their alloys; joining dissimilar materials)

2.8 explain the construction and design of welded joints (such as design principles of welded construction, joint design, behaviour of welded structures under static and dynamic loading)

2.9 explain the general principles of welding components and structures (such as use of jigs, fixtures and manipulating devices; residual stresses and distortion; types of defect and their avoidance; quality control during production)

2.10 explain the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality)

2.11 explain how to obtain information on the production welding requirements, and the types of information available (such as customer requirements and instructions, quality control requirements, product specification, manufacturing methods, equipment manuals/specifications)

2.12 explain how to obtain and interpret drawings, charts, specifications, manufacturers' manuals, history/maintenance reports and other documents needed in the problem solving process

2.13 explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken)

2.14 explain the principles of effective problem solving; the main problem solving methods and techniques in use, and how to apply them

2.15 explain the importance of collecting as much relevant information as possible, and of collating such information in a way that facilitates decision making, and the methods to achieve this

2.16 explain action planning (to include risk analysis, testing decisions, determining timescales and protecting the user/customer)

2.17 explain the importance of analysing problems from a variety of perspectives

2.18 explain how to define and verify the root cause of a problem

2.19 explain the importance of involving a range of relevant people in generating possible solutions

2.20 explain the importance of developing a range of possible options in solving problems

2.21 explain the factors to be taken into account when solving problems and determining suitable solutions, especially those covering working conditions and safety

2.22 explain how to present possible solutions in a way that helps relevant people to reach an informed and realistic judgement

2.23 explain how to determine and select permanent corrective actions (to include decision making, assessing the criteria and determining the risks, costs and generating alternatives)

2.24	explain how to prevent recurrence of the problems (to include proposed changes to management systems, operating systems and procedures, and the identification of opportunities for improvements)
2.25	explain the importance of maintaining records of the problem solving activities; what needs to be recorded, and where records are kept
2.26	explain the different ways in which the solutions can be reported back
2.27	explain who should be informed of actions taken, and by what means
2.28	explain the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve
2.29	explain the sources of technical expertise if they have problems that they cannot solve

Unit 450 Monitor Welding Activities in Production

UAN:	**H/505/0991**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 64: Monitoring Welding Activities in Production (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to monitor welding production activities, in accordance with approved procedures. The learner will be required to ensure that methods and procedures to achieve the required monitoring are available, that they are implemented correctly and that any problems or lack of compliance are identified. The learner's responsibilities will require them to comply with organisational policy and procedures for the monitoring activities undertaken, and to report any problems with those activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to apply their knowledge of welding technology to a range of work activities, performed in a variety of contexts and with a degree of personal responsibility and autonomy. Responsibility for the work of others and the allocation of resources may be present. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying monitoring procedures to welding production activities. The learner will understand the relevant welding technology and its application, and will know about the technology in adequate depth to provide a

sound basis for carrying out the monitoring activities to the required standard.

The learner will be aware of any company/customer, legislative or regulatory health, safety and environmental requirements applicable to the welding production activities being monitored. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. monitor welding activities in production
Assessment criteria
The learner can: 1.1 ensure that the required company methods and procedures for monitoring welding in production are available, to include four of the following: a. welding equipment manufacturer's recommendations b. quality assurance procedures and quality plans c. method statements d. manufacturing instructions e. risk assessments f. permits to work g. evaluation of weld properties 1.2 monitor the engineering process at suitable opportunities 1.3 ensure that implementation of the specified monitoring activities occurs in four of the following forms: a. observation b. data collection c. sampling d. testing, inspection or measurement of the product e. welding equipment records f. records produced by production or testing personnel g. periodic checking of equipment settings h. checking of production rate 1.4 ensure effective use of resources, by checking two of the following: a. scrap volumes b. down times c. repair rates d. compliance with specified scheduling 1.5 confirm that the materials used during the engineering process comply with specifications 1.6 ensure that the materials used comply with specifications and are in accordance with company, client and welding procedures, by means of two of the following: a. parent material certificates b. welding consumables certificates

c. non-destructive test (NDT) reports
d. destructive test reports
e. release notes
f. positive material identification (PMI)

1.7 confirm that suitable engineering methods and procedures have been used

1.8 identify any variations from agreed plans and schedules

1.9 ensure that any problems with the engineering process are identified

1.10 take action, in accordance with company procedures, if any problem or lack of compliance with specifications is identified, to include carrying out two of the following:

a. stopping production
b. quarantining defective goods/materials
c. taking planned remedial action
d. reporting to a higher authority
e. increasing sampling rates

1.11 ensure that the outputs of the engineering process comply with specifications

1.12 ensure that the engineering process complies with all relevant regulations and guidelines

1.13 ensure that the monitoring process complies with relevant regulations, standards and guidelines from all of the following, as appropriate:

a. statutory bodies
b. company policy and procedures
c. industry specific
d. client requirements
e. manufacturer specific
f. national
g. international

1.14 communicate the outcomes of the monitoring activity to the relevant people, using the following methods:

a. verbal report

plus one more method from the following:

b. specific company documentation
c. written or typed report
d. electronic mail
e. computer-based presentation

Learning outcome
The learner will: 2. understand how to monitor welding activities in production
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when working with production welding and related equipment (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, risk assessment procedures and relevant requirements of HASAWA, COSHH and work equipment regulations) 2.2 explain the personal protective clothing and equipment that should be worn (such as eye protection, ear protection, safety clothing) 2.3 explain the hazards associated with the production welding and related processes (such as arc flashes, fumes and gases, safety in enclosed/confined spaces, handling hot welded components/structures), and explain how they can be minimised 2.4 explain the welding production processes being monitored, and their technology (such as basic principles of fusion welding, ac and dc power sources, power ranges, manual metal arc (MMA), MIG, mag or cored-wire arc welding, tungsten arc welding (TIG), submerged arc, gas and plasma welding, electron beam, resistance welding, laser and friction welding and other relevant fusion welding processes) 2.5 explain how the various materials behave during welding (such as structure and property of metals; heat treatment requirements; types of steel and cracking phenomena, cast iron, copper, nickel, stainless steel, aluminium and their alloys; joining dissimilar materials) 2.6 explain the construction and design of welded joints (such as design principles of welded construction, joint design, behaviour of welded structures under static and dynamic loading) 2.7 explain the general principles of welding components and structures (such as use of jigs, fixtures and manipulating devices; residual stresses and distortion; types of defects and their avoidance; quality control during production) 2.8 explain the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality) 2.9 explain the monitoring methods and procedures that can be used (including when and how monitoring should be used), for the types of production welding activity within their area of responsibility 2.10 explain the potential variations from plans and schedules that might occur during the production process 2.11 explain the types of problem that could occur with the production or monitoring process, and explain the organisational methods and procedures for resolving them 2.12 explain the importance of solving problems quickly 2.13 explain how to check the outputs of the production process against those specified 2.14 explain the quality assurance systems that are being used 2.15 explain the procedures for obtaining information on resources, and

	how to verify that the resources used are suitable
2.16	explain the importance of maintaining records of the monitoring activities
2.17	explain the types of information to be recorded, and the amount of detail required
2.18	explain where records are kept, and the procedure for obtaining them
2.19	explain the importance of ensuring that any records that they use are correctly updated and returned to the appropriate location
2.20	explain the different ways of presenting information to different people
2.21	explain the organisational reporting processes and lines of communication
2.22	explain the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve
2.23	explain the sources of technical expertise if they have problems that they cannot solve

Unit 451 Inspect Welded Components or Structures for Visual Quality and Dimensional Accuracy

UAN:	**K/505/0992**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Fabrication and Welding Engineering Unit 65: Inspecting Welded Components or Structures for Visual Quality and Dimensional Accuracy (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out quality checks on welded components/structural units, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and quality assurance documentation during the inspection activities. The learner will be required to select the appropriate inspection equipment, based on the features to be checked and the accuracy to be measured. This will involve checking that the appropriate equipment is within current test dates and, where necessary, setting up and validating the equipment, ready for the inspection operations to be performed. In carrying out the inspection activities, the learner will be expected to check the welds for both dimensional accuracy and for visual weld quality, and this may be required to be undertaken at various stages of manufacture, such as before welding, intermediate and after welding. Before welding takes place, the learner will check that the materials to be fabricated are in the specified state and condition, and that the set-up arrangements for welding are correct. Inspection during manufacture will check

that welding activities are proceeding in accordance with the welding procedure specification and good practice. On completion of welding and fabrication activities, the learner will be expected to visually inspect the welded joints against the acceptance criteria, and to check that dimensions and distortion are within specified tolerances. The learner will be required to mark any areas where non-compliance exists, and to record the results of the inspection using the approved documentation process.

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

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying quality inspection procedures to welded products. The learner will understand the quality assurance process and its application, and will know about the equipment and inspection techniques, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with welded components, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be required to demonstrate safe working practices and procedures throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. inspect welded components or structures for visual quality and dimensional accuracy
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the inspection process: a. observe all the required safety procedures for the work area/activity b. obtain and use the correct issue of drawings, job instructions and welding procedure specifications c. obtain and check the condition and calibration dates of tools, measuring instruments and equipment used d. follow specified or appropriate inspection procedures e. identify and record out-of-specification features, in the appropriate format f. mark and identify areas where non-compliance with specification or defect indications are found g. leave the work area in a safe and tidy condition on completion of the inspection activities 1.3 follow the correct specification for the product or equipment being inspected 1.4 use the correct equipment to carry out the inspection 1.5 ensure that they have the required inspection equipment and that it is in good working order, to include six of the following, as appropriate to the operation/features being checked: a. weld measuring gauge b. rule, tape or other linear measuring device c. adjustable square/protractor d. depth gauge e. borescope f. roughness measuring equipment g. CCTV viewing system h. magnifying glass i. mirror j. portable lighting k. means of marking defective areas 1.6 identify and confirm the inspection checks to be made and acceptance criteria to be used 1.7 carry out the inspection checks to one or more of the following: a. approved construction drawings b. client specifications/detail drawings c. applicable national and international standards d. welding procedure specification 1.8 carry out all required inspections as specified 1.9 carry out specified prefabrication or sub-assembly inspection checks, to include all of the following: a. checking the condition of joint preparations

b. welded joint preparation dimensions
c. flatness or profile of sheets or plates, and linearity of sections
d. set-up arrangements for welding
e. condition of consumables

1.10 carry out the inspection of two of the following types of welded fabrication:
a. fabricated frames
b. structures
c. square/rectangular tanks
d. curved/profiled structures
e. pipe sections
f. cylindrical components
g. conical components
h. tubular structures
i. transition pieces
j. segmented bends
k. modular components
l. other specific fabrications

1.11 carry out specified inspection during fabrication, to check all of the following:
a. condition of weld root zone (where possible) and inter-runs
b. cleanliness of weld faces and surfaces
c. distortion and shrinkage

1.12 carry out the specified final inspection checks, to include all of the following:
a. overall dimensional tolerances
b. extent of distortion, shrinkage or misalignment
c. surface finish or roughness
d. visual appearance of welds/weld profile
e. evidence of damage requiring restoration
f. freedom from arc strikes
g. defect indications manifested on weld or parent metal surface
h. extent of excess metal, undercut, penetration or lack of penetration

1.13 identify any defects or variations from the specification

1.14 record the results of the inspection in the appropriate format

1.15 complete the inspection documentation, to include one from the following, and pass to the appropriate people:
a. weld inspection report
b. job card
c. customer specific documentation
d. concession report

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

Learning outcome
The learner will: 2. understand how to inspect welded components or structures for visual quality and dimensional accuracy
Assessment criteria
The learner can: 2.1 explain the specific safety precautions to be taken when inspecting welded components/structures (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, risk assessment procedures and relevant requirements of HASAWA, COSHH and work equipment regulations) 2.2 explain the personal protective clothing and equipment (PPE) that should be worn (such as leather gloves, eye protection, ear protection, safety harness) 2.3 explain the hazards associated with inspecting welded components/structures (such as working at height, safety in enclosed/confined spaces, handling welded components/structures, slips, trips and falls), and explain how they can be minimised 2.4 explain the welding processes being used, and their technology (such as basic principles of fusion welding, ac and dc power sources, power ranges, manual metal arc (MMA), MIG, MAG or cored-wire arc welding, tungsten arc welding (TIG), submerged arc, gas and plasma welding, electron beam, resistance welding, laser and friction welding and other relevant fusion welding processes) 2.5 explain how the materials behave during welding (such as structure and property of metals; heat treatment requirements; types of steel and cracking phenomena, cast iron, copper, nickel, stainless steel, aluminium and their alloys; joining dissimilar materials) 2.6 explain the construction and design of welded joints (such as design principles of welded construction, joint design, behaviour of welded structures under static and dynamic loading 2.7 explain the general principles of welding components and structures (such as use of jigs, fixtures and manipulating devices; residual stresses and distortion; types of defect and their avoidance; quality control during manufacture) 2.8 explain how and where to obtain the required drawings and related specifications, and how to check that they are current and complete 2.9 explain how to extract the information required from the drawings and welding procedure specifications (such as interpretation of welding symbols; scope, content and application of the welding procedure specification) to include symbols and conventions to appropriate British, European or relevant international standards in relation to work undertaken 2.10 explain the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality) 2.11 explain the use of British, European, international and client standards in determining if welded fabrications are fit for purpose 2.12 explain the general principles of quality assurance systems and procedures

2.13	explain the preparations to be undertaken before the welded fabrications are inspected (such as access to welded area, cleanliness and physical condition of welded area)
2.14	explain the visual and dimensional inspection methods and techniques that are used for welded components/structures
2.15	explain the equipment that is used to carry out the various inspection checks (such as rules and tapes, weld measuring gauge, borescope, optical aids (such as magnifying glass and mirror), CCTV viewing system)
2.16	explain the items to be checked prior to welding the components/structures (such as joint preparation, joint setup, parent metal condition, condition of consumables, equipment settings)
2.17	explain the features of the welded joints that must be checked (such as linearity or profile, weld root run, inter-runs, final dimensional tolerances, distortion, shrinkage, visual appearance of welds, excess weld metal, undercut, penetration and profile)
2.18	explain how to calculate allowances for weld gaps and weld shrinkage, in order to attain overall global tolerances
2.19	explain the acceptance criteria to be used, and the influence of defects on the service performance of the welded components/structures (including risks and consequences of failure)
2.20	explain the importance of carrying out the checks and recording the results in the appropriate documentation
2.21	explain the procedure to be followed when inspected products are out of specification
2.22	explain the importance of completing inspection documentation; what must be recorded, and where records are kept
2.23	explain the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 452 Lead Welding and Fabrication Activities

UAN:	**L/505/0967**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 37 Leading welding and fabrication activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead welding and fabrication activities to ensure that all the products manufactured are fit for purpose and meet the required quality specification on time and to budget. The learner will be required to agree and monitor departmental budgets, the review of product standards and other supplementary requirements, assess the capability to meet prescribed requirements and perform technical reviews to establish parent material specifications and welded joint properties, inspection, testing, quality and acceptance requirements in accordance with approved procedures and policies. The learner will also be required to establish the required qualifications and experience for personnel and select competent welders and welding operators, welding inspectors and NDT operators. The learner will also select suitable welding and associated equipment, including personal protective equipment, for the production. The learner will be required to consider the necessary methods and actions for calibration and validation of measuring, inspection and testing equipment. The learner will also be required to identify and implement a systematic approach to improving the welding and fabrication activities undertaken.

The learner's responsibilities will require them to comply with organisational policy and processes for the storage, handling and traceability of materials, including welding consumables.

The learner will be required to prepare and maintain quality records, including non-conformance and corrective actions, reporting any problems that they cannot personally resolve, or that are outside of their permitted authority, to the relevant people. The learner must ensure that that all necessary data and documentation is completed accurately and legibly and stored in the correct location and format. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the welding and fabrication work carried out.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying a range of leadership methods and techniques to ensure that the welding and fabrication activities undertaken are fit for purpose and meet the quality specification on time and to budget. The learner will know about the welding and fabrication processes and associated quality assurance requirements in an adequate depth to provide a sound basis for leading the welding and fabrication activities. In addition, the learner will have sufficient knowledge on how to develop the welding and fabrication team and how to identify and implement a systematic approach to improving the welding and fabrication activities undertaken.

The learner will understand the safety precautions required when carrying out the welding and fabrication activities. The learner will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. lead welding and fabrication activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead the welding and fabrication activities by carrying out all the following: a. interpret the Health and Safety Regulations for the welding and fabrication environment and apply controls, mitigation and protective equipment to address the risk factors associated with welding, cutting, grinding and NDT b. obtain accurate details of the products to be welded or fabricated c. review and interpret the product specification and documentation to assess their characteristics and requirements d. clarify any aspects of the product specification or timescales that are unclear e. communicate the welding, inspection, testing and fabrication activities to be undertaken with the team f. involve the team in planning how the welding and fabrication activities will be achieved g. provide clear and accurate instructions to all the relevant people h. advise welding personnel on welding instructions and techniques i. secure, monitor and control the use of resources to achieve the most effective results j. confirm and communicate any changes to the product specification and/or timescales required by the customer k. allocate specific jobs/tasks to appropriate personnel l. motivate the team to present their own ideas on improvements that could be made to the manufacturing process and procedures m. encourage the team and/or individuals to take the lead where appropriate n. deal efficiently and effectively with problems affecting production/inspection output o. produce and agree contingency plans when required 1.3 carry out all the following whilst leading the welding and fabrication activities: a. interpret weld drawings and weld symbols, understand and apply the correct codes, standards and welding procedures for the scope of production b. review and verify that welder qualifications are valid for the scope of production, assign welders and control their deployment c. select the correct welding and associated equipment and verify that it is serviceable and calibrated d. select, supply and control the traceability of verified parent

materials, check joint preparation, fit-up and cleanliness before welding

e. identify welding consumables, verify welding consumables against documentation, and control their storage and supply
f. control the welding parameters, techniques, sequences, preheating, heat input and heat treatment
g. apply visual inspection to the control of weld finish and dimensions, and control of the shape and dimensions of the part, component or assembly
h. assign appropriate non-destructive testing of the welds
i. assess inspection and test reports and identify the factors affecting weld defects and apply acceptance criteria from relevant codes, standards or specifications
j. identify the nature and extent of production problems, evaluate and select solutions, and control weld repair and rework
k. prepare, review, maintain and archive inspection reports and weld quality records

1.4 develop, gain agreement and review departmental budgets

1.5 produce, agree and update departmental schedules and plans

1.6 prepare and plan welding and fabrication activities by carrying out all of the following:

a. select materials, welding process, equipment and consumables based on weld and fabrication drawings and application standards or contract specifications
b. compile and review welding procedures for welded components in accordance with national and international standards
c. interpret and apply standards to the qualification of a welding procedure, recognising the main variables and its range of qualification
d. determine the main variables for a particular welder/welding operator qualification and its range of qualification, and initiate and maintain welder qualification tests and records
e. select and apply appropriate fixtures, jigs or positioners to improve weldability or productivity in a particular welded fabrication
f. select and apply auxiliary equipment, and cables, heat treatment equipment and temperature controls for a particular welding procedure
g. analyse welding production rates and costs and schedule welding and handling activities to achieve requirements

1.7 ensure that schedules and plans are capable of meeting the required outputs

1.8 lead welding or fabrication activities

1.9 lead one of the following activities :

weld repair

a. produce a welding procedure qualification, recognising the problems of making repair welds
b. coordinate the safety requirements for an in-service weld repair, with regard to specific needs such as hot working permit, fume control and special access or confined space training
c. select appropriate welding personnel, equipment and

consumables to be applied to a specific weld repair procedure

or

welding of reinforcing steel

d. select appropriate joints for load bearing and non-load bearing
e. determine joint length and preheat for specified steel types and diameters
f. select appropriate welding processes welding of reinforcing steel to satisfy requirements of standards (such as ISO 17660 series and National Standards) and specifications

1.10 complete and save relevant welding or fabrication data and documentation accurately

1.11 identify and lead on making improvements to processes and procedures

1.12 identify and implement improvements in the manufacturing/inspection department to achieve four of the following:

a. reduced production costs
b. reduced lead times
c. improved quality
d. improved equipment/tooling efficiency
e. improved staff utilisation
f. improved working practices
g. improved equipment downtime
h. improved equipment utilisation
i. improved use of production/inspection technologies
j. improved use of information technology
k. improved health and safety
l. improved visual management systems/documentation
m. improved resource planning
n. improved staff development and training
o. reduction in waste
p. reduction in energy usage
q. improved environmental impact
r. improved customer service
s. other (to be specified)

1.13 ensure welding or fabrication activities are carried out correctly in line with approved company processes and procedures

1.14 lead quality assurance and quality control activities for welding and fabrication by carrying out all of the following:

a. produce and implement effective quality control procedures
b. interpret and apply relevant standards (such as. ISO 9000, and ISO 3834) to storage, supply, control and traceability of materials and consumables, including calibration of equipment
c. recognise the basic factors related to personnel and equipment that influence the quality in a welded fabrication, and control them to achieve specified results
d. apply Inspection Quality Test Plans/Written Schemes of Examination in accordance with application standards or contract specifications, and demonstrate correct use of acceptance standards for weld imperfections
e. control welding quality, residual stresses and distortion through measurement of welding parameters and

measurement and control of heat treatment operations

1.15 ensure welded or fabricated products complies with three of the following:
   a. organisational guidelines and procedures
   b. equipment manufacturer's operating specification/range
   c. British, European or International standards or directives
   d. recognised compliance agency/body standards or directives
   e. health, safety and environmental requirements
   f. customer standards and requirements

1.16 create and update visual management documentation and systems to support the activities of the department

1.17 create and maintain management data and information to include the following:
   a. welding or fabrication work plans/delivery schedules

   plus supporting documentation associated with three of the following
   b. quality records/defects
   c. problem history/resolution
   d. resources/materials requisitions
   e. budgets
   f. equipment performance
   g. equipment maintenance
   h. equipment downtime/failure
   i. equipment utilisation
   j. health and safety
   k. staff development and training
   l. department procedures/work instructions
   m. tests and trials
   n. regulatory compliance
   o. justification of the purchase and/or application of innovative/new welding equipment

1.18 report and evaluate the impact of improvement activities

1.19 complete the relevant documentation to include one from the following:
   a. job/route cards
   b. company-specific production recording system

1.20 produce and maintain departmental competency skills matrix of team members

1.21 provide technical advice and guidance as required

Learning outcome
The learner will: 2. understand how to lead welding and fabrication activities
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the welding or fabrication activity is to take place and the responsibility these requirements place on them 2.2 explain the information systems that are in use within their organisation and how to record data to the system 2.3 explain how to obtain and interpret legislative and regulatory documentation 2.4 explain how to obtain and interpret company policies and procedures 2.5 explain how to prioritise their own and their team's workload to ensure that targets are met 2.6 explain the process to be followed to develop and gain agreement on departmental budgets 2.7 explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out 2.8 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.9 explain the importance of ensuring that teams have the required skills, knowledge, experience, behaviours and where appropriate qualifications in order to weld or fabricate components to the required standards 2.10 explain how to access training and development programmes once a training need has been identified 2.11 explain the specific health and safety precautions to be applied during the welding or fabrication and process and their effects on others 2.12 explain how to complete and review risk assessments 2.13 explain the hazards associated with carrying out activities in the department and how to minimise these and reduce any risks 2.14 explain the importance of ensuring employees wear protective clothing and other appropriate safety equipment during the welding or fabrication process 2.15 explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the welding or fabrication process 2.16 explain who to contact if clarification is required on the welding or fabrication requirements 2.17 explain who should be involved in authorising any changes required to welding or fabrication activities 2.18 explain the methods used to calculate how long it should take to complete specific work outputs 2.19 explain the procedure for purchasing/obtaining materials and other consumables necessary for the welding or fabrication activities 2.20 explain the criteria for selection and application of different welding consumables

2.21 explain the classification, properties and typical applications of steels, aluminium alloys and other engineering materials in common use

2.22 explain the methods for identification of relevant materials and components

2.23 explain the characteristics and application of welding and cutting processes

2.24 explain the operation, maintenance and calibration requirements of the principal components of welding power sources and ancillary equipment

2.25 explain the characteristics and benefits of automated and mechanised welding processes

2.26 explain the terms, symbols and definitions used in weld and fabrication drawings and specifications

2.27 explain the principles of quality assurance and quality control and recognise the related standards and their application to welded fabrication as a special process

2.28 explain the requirements and function of quality control during manufacture, the standards related to welding operators and welding procedure qualification including joint traceability methods, the need for calibration, and monitoring of process parameters

2.29 explain the main factors affecting welding stress and distortion in welded fabrications and how these effects can be measured and minimised

2.30 explain the need for, and function of, auxiliary equipment, jigs and fixtures from the viewpoint of quality, economics and the environment

2.31 explain the methods of controlling the properties of welded joints, including strength, toughness, hardness, and corrosion resistance

2.32 explain the effect of heat treatment, including normalising, annealing, preheating, quench and tempering, solution treatment and post-weld heat treatment

2.33 explain the methods and equipment used for heat treatment

2.34 explain the purpose and application of hydrostatic test methods

2.35 explain the need for and application of destructive mechanical testing

2.36 explain the purpose and application of inspection quality test plans or written schemes of examination

2.37 explain the requirements for measurement, control and recording during welding and allied operations

2.38 explain the principles of imperfections and acceptance criteria

2.39 explain the use of non destructive testing as applied to welding fabrications

2.40 explain the economics of welding operations applied to welded fabrications

2.41 explain the problems of repair welding both for in manufacture and in-service situations

2.42 explain the principles of choice of joints in reinforcing steels and their design

2.43 explain the importance of keeping up to date with new technologies, welding and fabrication methods and techniques

2.44 explain the quality assurance and control methods that are used in the department

2.45	explain the personnel involved to ensure that the quality of product outcomes are fit for purpose and their responsibilities to ensure this is achieved
2.46	explain the process and procedures to be followed when defective products are identified both during production/on completion of the welding or fabrication process
2.47	explain the organisational procedure(s) to be adopted for the safe disposal of all types of waste materials
2.48	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.49	explain how to use “root cause” problem solving analysis using the 5 whys/how technique
2.50	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.51	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.52	explain how to create, review and modify standard operating procedures (sop’s) and correlate work activities into them
2.53	explain the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.54	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 453 Lead Rail Welding Activities

UAN:	**R/505/0968**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 38 Leading rail welding activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead a safety culture, and apply safe systems of work when carrying out rail welding activities, including agreeing and monitoring departmental budgets. The learner will be required to lead rail welding and renewal activities, including review of standards and other supplementary requirements, assurance of operator competence, assessment of the capability to meet the prescribed requirements, and technical review to establish parent material specifications and welded joint properties, inspection, testing, quality and acceptance requirements in accordance with approved procedures and policies. The learner will monitor and report activities to ensure that the welded rails are fit for purpose and meet the required quality specification on time and to the agreed budget. The learner will be required to establish the necessary required qualifications for personnel and select competent welders and welding operators, welding inspectors and NDT operators. The learner will also select suitable welding and associated equipment, including personal protective equipment, for the activity. The learner will be required to consider the necessary methods and actions for calibration and validation of measuring, inspection and testing equipment.

The learner will also be required to identify and implement a systematic approach to improving the rail welding activities undertaken.

The learner's responsibilities will require them to comply with organisational policy and processes for the storage, handling and traceability of materials, including welding consumables.

The learner will be required to prepare and maintain quality records, including non-conformance and corrective actions, reporting any problems that they cannot personally resolve, or that are outside of their permitted authority, to the relevant people. The learner must ensure that that all necessary data and documentation is completed accurately and legibly and stored in the correct location and format. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the welding work carried out. The learner will be required to determine the remedial action necessary for welds that do not meet the acceptance criteria.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying a range of leadership methods and techniques to ensure that the rail welding activities undertaken are fit for purpose and meet the quality specification on time and to budget. The learner will understand about the rail welding processes and associated quality assurance requirements in sufficient depth to provide a sound basis for leading the rail welding activities. In addition, the learner will have sufficient understanding on how to develop the team and how to identify and implement a systematic approach to improving the rail welding activities undertaken.

The learner will understand the safety precautions required when carrying out the rail welding activities. The learner will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the work area.

Learning outcome
The learner will: 1. lead rail welding activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead the rail welding activities by carrying out all the following: a. interpret the Health and Safety regulations for the rail welding environment and apply controls, mitigation and protective equipment to address the risk factors associated with welding, cutting, grinding and NDT b. obtain accurate details of the rails to be welded c. review and interpret the rail welding specification and documentation to assess their characteristics and requirements d. clarify any aspects of the rail welding specification or timescales that are unclear e. involve the team in planning how the rail welding activities will be achieved f. select, check, issue and brief safe systems of work plans, method statements, work package plans, work plans and briefing documents for specified track maintenance or renewal tasks g. provide clear and accurate instructions to all the relevant people h. advise welding personnel on welding instructions i. secure, monitor and control the use of resources to achieve the most effective results j. confirm and communicate any changes to the rail welding specification and/or timescales required by the customer k. allocate specific jobs/tasks to appropriate and competent personnel l. motivate the team to present their own ideas on improvements that could be made to the manufacturing process and procedures m. encourage the team and/or individuals to take the lead where appropriate n. deal efficiently and effectively with problems affecting the rail welding activities o. produce and agree contingency plans when required 1.3 carry out all the following whilst leading rail welding activities: a. interpret weld drawings and weld symbols, understand and apply the correct codes, standards and welding procedures b. review and verify that welder qualifications are valid, assign welders and control their deployment c. select the correct welding and associated equipment and verify that it is serviceable and calibrated d. select, supply and control the traceability of verified parent materials, check joint preparation, fit-up and cleanliness before welding e. identify welding consumables, verify welding consumables against documentation, and control their storage and supply

f. control the welding parameters, techniques, sequences, preheating, heat input and heat treatment
g. apply visual inspection to the control of weld finish and dimensions, and control of the shape and dimensions of the welded rails
h. assign appropriate non-destructive testing of the welds
i. assess inspection and test reports and identify the factors affecting weld defects and apply acceptance criteria from relevant codes, standards or specifications
j. identify the nature and extent of production problems, evaluate and select solutions, and control weld repair and rework
k. prepare, review, maintain and archive inspection reports and weld quality records

1.4 correctly develop, gain agreement of and review departmental budgets

1.5 produce, agree and update effective departmental schedules and plans

1.6 prepare and plan rail welding activities by carrying out all of the following:

a. select materials, equipment and consumables based on weld drawings and application standards or contract specifications
b. compile and review welding procedures for welded components in accordance with specifications, national and international standards
c. interpret and apply standards to the qualification of a welding procedure, recognising the main variables and its range of qualification
d. determine the main variables for a particular welder/welding operator qualification and its range of qualification, and initiate and maintain welder qualification tests and records
e. select and apply appropriate plant, fixtures, jigs or positioners to improve weldability or productivity
f. analyse welding production rates and costs and schedule welding and handling activities to achieve requirements

1.7 ensure that schedules and plans are capable of meeting the required outputs

1.8 lead rail welding activities

1.9 lead one of the following activities :

a. Rail welding using aluminothermic and flash – butt processes
b. determine the safe systems of work for track access, mechanical and oxy-fuel gas cutting, aluminothermic and flash-butt welding processes, and NDT for rail welding
c. select appropriate procedures for specified rail types and materials.
d. select appropriate welding and inspection personnel, equipment and consumables to be applied
e. select and apply appropriate testing and measurement techniques and apply acceptance criteria to results

or

f. Rail or track component repair using arc welding
g. determine the safe systems of work for track access, grinding/gouging, welding processes and NDT for rail repair
h. identify and measure in-service defects and direct application

of grinding/gouging and NDT for preparation or the surface for repair

i. produce a welding procedure qualification, recognising the problems of making repair welds
j. select appropriate welding personnel, equipment and consumables to be applied to a specific weld repair procedure
k. select and apply appropriate testing and measurement techniques and apply acceptance criteria to results

1.10 accurately complete and save relevant rail welding data and documentation accurately

1.11 identify and implement effective improvements to processes and procedures

1.12 identify and implement improvements in the delivery unit/inspection department to achieve four of the following:

a. reduced production costs
b. reduced lead times
c. improved quality
d. improved equipment/tooling efficiency
e. improved staff utilisation
f. improved working practices
g. improved equipment downtime
h. improved equipment utilisation
i. improved use of production/inspection technologies
j. improved use of information technology
k. improved health and safety
l. improved visual management systems/documentation
m. improved resource planning
n. improved staff development and training
o. reduction in waste
p. reduction in energy usage
q. improved environmental impact
r. improved customer service
s. other (to be specified)

1.13 ensure rail welding activities are carried out correctly in line with approved company processes and procedures

1.14 lead quality assurance and quality control activities for rail welding by carrying out all of the following:

a. produce and implement effective quality control procedures.
b. interpret and apply relevant standards (such as ISO 9000, and ISO 3834) to storage, supply, control and traceability of materials and consumables, including calibration of equipment
c. recognise the basic factors related to personnel and equipment that influence weld quality, and control them to achieve specified results
d. develop surveillance plans and inspection programmes in accordance with application standards or contract specifications, and demonstrate correct use of acceptance standards for in-service defects and weld imperfections
e. apply appropriate methods of measurement to the control of welding and allied operations
f. control welding quality, residual stresses and distortion through measurement of welding parameters and

measurement and control of welding sequence and heat input

1.15 ensure welded rails complies with three of the following:
   a. organisational guidelines and procedures
   b. equipment manufacturer's operating specification/range
   c. British, European or International standards or directives
   d. recognised compliance agency/body standards or directives
   e. health, safety and environmental requirements
   f. customer standards and requirements

1.16 accurately create and update visual management documentation and systems to support the activities undertaken

1.17 create and maintain management data and information to include the following:
   a. rail welding work plans/delivery schedules

   plus supporting documentation associated with three of the following
   b. quality records/defects
   c. problem history/resolution
   d. resources/materials requisitions
   e. budgets
   f. equipment performance
   g. equipment maintenance
   h. equipment downtime/failure
   i. equipment utilisation
   j. health and safety
   k. staff development and training
   l. department procedures/work instructions
   m. tests and trials
   n. regulatory compliance

1.18 evaluate and report on the impact of improvement activities

1.19 produce and maintain a competency skills matrix of team members to effectively manage personnel competence in accordance with requirements

1.20 complete the relevant documentation to include one from the following:
   a. job cards
   b. company-specific recording system

Learning outcome
The learner will: 2. understand how to lead rail welding activities
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the rail welding activity is to take place, and the responsibilities that these requirements place on them 2.2 explain the information systems that are in use within their organisation, and how to record data to the system 2.3 explain how to obtain and interpret legislative and regulatory documentation

2.4 explain how to obtain and interpret company policies and procedures
2.5 explain how to prioritise their own and their team's workload to ensure that targets are met
2.6 explain the process to be followed to develop and gain agreement on departmental budgets
2.7 explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out
2.8 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
2.9 explain the importance of ensuring that teams have the required skills, knowledge, experience and behaviours in order to weld rails to the required standards
2.10 explain how to access training and development programmes once a training need has been identified
2.11 explain the specific health and safety precautions to be applied during the rail welding and their effects on others
2.12 explain how to complete and review risk assessments
2.13 explain the hazards and risks associated with carrying out activities
2.14 explain the methods and practices that should be used to minimise hazards and risks
2.15 explain the importance of ensuring employees wear protective clothing and other appropriate safety equipment during the rail welding
2.16 explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the rail welding process
2.17 explain who to contact if clarification is required on the rail welding tasks to be completed
2.18 explain who should be involved in authorising any changes required to the rail welding activities
2.19 explain the methods used to calculate how long it should take to complete specific work tasks
2.20 explain the procedure for purchasing/obtaining materials and other consumables necessary for the rail welding activities
2.21 explain the health and safety hazards associated with rail welding and fabrication processes, including techniques to minimise them.
2.22 explain the classification and properties of rail grades and profiles, including the metallurgy and weldability of cast metals, steels, aluminium alloys and other engineering materials in common use.
2.23 explain the development of modern track technology, including standards and abbreviations
2.24 explain the design principles, different types of loading, in-service defects, failure types and the influence of ambient conditions on rail constructions
2.25 explain the principles of quality assurance and quality control as applied to rail welding
2.26 explain the factors affecting welding stress and distortion in welded rail and how these effects can be measured and minimised
2.27 explain the characteristics and application of rail welding and cutting processes, including aluminothermic welding, flash-butt welding, arc welding, mechanical cutting and gas cutting
2.28 explain the operation, maintenance and calibration requirements of

the principal components of welding and ancillary equipment

2.29 explain the application of cutting and arc welding processes to rail including repair and maintenance

2.30 explain the development of arc welding procedure specifications for rail welding

2.31 explain the production and use of process manuals

2.32 explain the use of non destructive testing as applied to rail welds and track components

2.33 explain the special requirements and necessary activities in the application of rail welding (such as rail industry documentation, standards and specifications)

2.34 explain the need for, and function of plant, auxiliary equipment, jigs and fixtures from the viewpoint of quality, economics and the environment

2.35 explain the methods of controlling the properties of welded joints, including strength, toughness, hardness, and corrosion resistance

2.36 explain the purpose and application of surveillance programmes and inspection plans for identification and monitoring of in-service defects and acceptance of welds

2.37 explain the requirements for measurement, control and recording during welding and allied operations

2.38 explain the principles of imperfections and acceptance criteria

2.39 explain the remedial actions necessary for welds that do not meet the acceptance criteria

2.40 explain the economics of welding operations applied to rail fabrication and renewal

2.41 explain the problems of repair welding both for on and off track situations

2.42 explain the quality assurance and control methods that are used

2.43 explain the personnel involved to ensure that the quality of product outcomes are fit for purpose and their responsibilities to ensure this is achieved

2.44 explain the process and procedures to be followed when defective products are identified during and on completion of the rail welding activity

2.45 explain the organisational procedure(s) to be adopted for the safe disposal of all types of waste materials

2.46 explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement

2.47 explain how to use “root cause” problem solving analysis using the 5 whys/how technique

2.48 explain how to evaluate improvement ideas in order to select those that are to be pursued

2.49 explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process

2.50 explain how to create, review and modify standard operating procedures (sop’s) and correlate work activities into them

2.51 explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, graphs and charts, team boards)

2.52 explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 454 Lead Maintenance Activities

UAN:	**A/505/0964**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 34 Leading maintenance activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead a maintenance team, including agreeing and monitoring budgets, developing and updating maintenance schedules such as preventive, corrective, predictive and reactive programmes in accordance with approved procedures and policies. Working with in company and/or contract maintenance staff they will also be responsible for ensuring that staff have the appropriate skills knowledge and understanding required to maintain the equipment, components, products or services. The learner will also be required to identify and implement a systematic approach to improving the maintenance activities undertaken. The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner must ensure that that all necessary data, documentation is completed accurately and legibly and stored in the correct location and format. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for

the quality and accuracy of the work carried out by the maintenance team.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying a range of maintenance schedules and programmes. The learner will know how the equipment or service supplies functions and the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for leading the maintenance activities, correcting faults and ensuring the repaired equipment/services functions to the required specification and remains compliant with all standards and regulations. In addition, the learner will have sufficient knowledge on how to develop maintenance teams and how to identify and implement a systematic approach to improving the maintenance activities undertaken

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

Learning outcome
The learner will: 1. lead maintenance activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 maintain equipment which complies with three of the following: a. organisational guidelines and procedures b. equipment manufacturer's operating specification/range c. British, European or International standards or directives d. recognised compliance agency/body standards or directives e. health, safety and environmental requirements f. customer standards and requirements 1.3 develop, gain agreement and review maintenance budgets 1.4 produce, agree and update maintenance procedures, schedules and plans 1.5 develop and update maintenance procedures, schedules and plans to include three of the following: a. preventive maintenance (routine inspections and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities)

c. predictive maintenance (analysis of the equipment's condition)
d. reactive maintenance (unexpected equipment/component failure)
e. maintenance prevention (equipment/component design and development)

1.6 produce and maintain a departmental competency skills matrix of team members

1.7 plan, schedule and carry out maintenance activities using two of the following resources:
a. complete in-house staff
b. combined in-house/contract staff
c. complete contract maintenance staff

1.8 ensure that schedules and plans are capable of meeting all relevant outputs required

1.9 lead maintenance activities within the department

1.10 lead a maintenance team by carrying out all the following:
a. communicate the maintenance activities to the team
b. involve the team in planning how the maintenance activities will be undertaken
c. allocate specific maintenance activities to each team member
d. motivate the team to present their own ideas on improvements that could be made to the maintenance process and procedures
e. encourage the team and/or individuals to take the lead where appropriate

1.11 lead maintenance activities on two of the following types of equipment:
a. mechanical equipment (such as cyclic and rotational devices, gearboxes, drives, linkages)
b. production machinery (such as machine tools, presses, transfer mechanisms)
c. process equipment (such as furnaces, chemical baths)
d. rotating electrical machinery (such as generators, motors)
e. stationary electrical equipment (such as transformers, switchgear)
f. stationary plant and equipment (such as air receivers, accumulators, tanks, piping)
g. emergency standby or alarm/warning systems and equipment
h. fluid power equipment (such as pipework, cylinders/actuators, pumps)
i. process controller (such as program controller, input/output interfacing, wiring/cabling, monitoring sensors)
j. electrical components (such as power supplies, switch gear and distribution panels, control systems)
k. environmental systems (such as air conditioning, lighting, fume extraction)
l. engines (such as piston, turbine)
m. rotating or reciprocating machinery (such as pumps, compressors)
n. Integrated systems (such mechanical electrical, fluid power, process control)
o. structural equipment /components (such as aircraft wings, bodies, boat hulls/super structures)

p. services (such as water, gas, air, electricity)

1.12 complete and store relevant maintenance data and documentation accurately

1.13 identify and lead on making improvements to maintenance processes and procedures

1.14 identify and implement improvements in the services provided by the maintenance team to include four of the following:

a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions
f. visual management systems/documentation
g. resource planning
h. costs
i. staff development and training
j. health and safety
k. procurement
l. other (to be specified)

1.15 ensure maintenance activities are carried out correctly in line with agreed company processes and procedures

1.16 create and update visual management documentation and systems to support the activities of the maintenance department

1.17 create and maintain visual management records to include three of the following:

a. preventive maintenance (routine inspections, and adjustments)
b. corrective maintenance (activities identified from preventative maintenance activities)
c. predictive maintenance (analysis of the equipment's condition)
d. reactive maintenance (unexpected equipment/component failure)

plus supporting documentation associated with four of the following

e. equipment performance
f. equipment downtime/failure
g. overall equipment effectiveness (OEE)
h. maintenance costs
i. health and safety
j. staff development and training
k. maintenance procedures/instructions
l. operator manuals/working instructions
m. regulatory compliance

1.18 report and evaluate the impact of maintenance programmes and improvement activities

1.19 complete the relevant maintenance documentation to include one from the following:

a. job cards
b. permit to work/formal risk assessment and/or sign-on/off procedures
c. maintenance log or report
d. company-specific documentation

Learning outcome
The learner will: 2. understand how to lead maintenance activities
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them 2.2 explain the information systems that are in use within their organisation, and how to record data to the system 2.3 explain how to obtain and interpret legislative and regulatory documentation 2.4 explain how to obtain and interpret company policies and procedures 2.5 explain how to prioritise their own and their team's workload to ensure that targets are met 2.6 explain the process to be followed to develop and gain agreement on departmental budgets 2.7 explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out 2.8 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.9 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards 2.10 explain how maintenance teams access training and development programmes once a need training need has been identified 2.11 explain the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others 2.12 explain how to complete and review risk assessments 2.13 explain hazards associated with carrying out activities (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risks 2.14 explain the importance of ensuring employees wear protective clothing and other appropriate safety equipment during maintenance process 2.15 explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process 2.16 explain the importance of implementing an effective maintenance strategy to reduce the amount of equipment/component failures/downtime 2.17 explain how to deal with changes requested to the maintenance schedules 2.18 explain who to contact for clarification of the maintenance requirements or problem 2.19 explain who should be involved in authorising any changes required to maintenance activities

2.20 explain the principles of the different types of maintenance programmes such as preventive, corrective and predictive and their benefits

2.21 explain the procedure for purchasing/obtaining replacement parts, materials and other consumables necessary for the maintenance activities

2.22 explain how to determine the resources that are required to undertake the maintenance activities

2.23 explain the methods and parameters used to calculate how long it should take to complete specific maintenance activities

2.24 explain the company policy on repair/replacement of equipment or components during the maintenance process

2.25 explain the procedures to be adopted for the dismantling/re-assembly of various types of assemblies

2.26 explain the process to determine if products or service supplies are fit for purpose

2.27 explain the basic principles of how the equipment functions, operation sequence, the working purpose of individual units/components and how they interact

2.28 explain the importance of keeping up to date with new technologies, manufacturing processes and systems

2.29 explain the applications of mechanical and electrical measuring and testing equipment

2.30 explain the importance of keeping up to date maintenance documentation and/or reports

2.31 explain the equipment operating and control procedures to be applied during the maintenance activity

2.32 explain the problems associated with the maintenance activity, and how they can be overcome

2.33 explain the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials

2.34 explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement

2.35 explain how to use “root cause” problem solving analysis using the 5 whys/how technique

2.36 explain how to evaluate improvement ideas in order to select those that are to be pursued

2.37 explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process

2.38 explain how to create standard operating procedures (sop’s) and correlate work activities into them.

2.39 explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)

2.40 explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 455 Lead Mechanical Manufacturing or Inspection Activities

UAN:	**F/505/0965**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 35 Leading mechanical manufacturing or inspection activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead a mechanical manufacturing or inspection team, including agreeing and monitoring departmental budgets, developing and updating production/inspection schedules and plans in accordance with approved procedures and policies, to ensure that the products manufactured/inspected are fit for purpose and meet the required quality specification on time and to budget. The learner will also be required to ensure that the team have the appropriate skills knowledge and understanding required to produce/inspect the products required in the manufacturing area they have responsibility for. The learner will also be required to identify and implement a systematic approach to improving the manufacturing/inspection activities undertaken. The learner's responsibilities will require them to comply with organisational policy and procedures for the mechanical manufacturing/inspection activities undertaken, and to report any problems with the activities that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The

learner must ensure that that all necessary data, documentation is completed accurately and legibly and stored in the correct location and format. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work carried out by the mechanical manufacturing/inspection team.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying a range of leadership methods and techniques to ensure that the products manufactured/inspected are fit for purpose and meet the quality specification on time and to budget. The learner will know about the tools and equipment and consumables required in an adequate depth to provide a sound basis for leading the mechanical manufacturing/inspection activities. In addition, the learner will have sufficient knowledge on how to develop the manufacturing/inspection team and how to identify and implement a systematic approach to improving the manufacturing/inspection activities undertaken.

The learner will understand the safety precautions required when carrying out the mechanical manufacturing/inspection activities. The learner will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. lead mechanical manufacturing or inspection activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead the mechanical manufacturing/inspection team by carrying out all the following: a. obtain accurate details of the products to be manufactured/inspected b. review and interpret the product specification and documentation to assess their characteristics and requirements c. clarify any aspects of the product specification or timescales

that are unclear
d. communicate the manufacturing/inspection activities to be undertaken with the team
e. involve the team in planning how the manufacturing/inspection activities will be achieved
f. provide clear and accurate instructions to all the relevant people
g. secure, monitor and control the use of resources to achieve the most effective results
h. confirm and communicate any changes to the product specification and/or timescales required by the customer
i. allocate specific jobs/tasks to each team member
j. motivate the team to present their own ideas on improvements that could be made to the manufacturing process and procedures
k. encourage the team and/or individuals to take the lead where appropriate
l. deal efficiently and effectively with problems affecting production/inspection output
m. produce and agree contingency plans when required

1.3 develop, gain agreement and review manufacturing/inspection departmental budgets

1.4 obtain operational information from three of the following:
a. design office
b. industrial engineering
c. quality engineering
d. process engineering
e. production engineering
f. company information systems
g. customer
h. sales department
i. component/product manufacturers
j. material/component supplier
k. other (to be specified)

1.5 produce, agree and update departmental production/inspection schedules and plans

1.6 ensure that schedules and plans are capable of meeting all relevant outputs required

1.7 lead mechanical manufacturing/inspection activities within the department

1.8 lead mechanical manufacturing/inspection activities for one of the following processes:
a. machining
b. assembly
c. welding
d. fabrication
e. toolmaking
f. product overhaul, test and repair
g. metal production
h. composite manufacture
i. woodworking, pattern or modelmaking
j. materials processing and finishing

k. inspection or testing of products/components
l. other product/component manufacturing/processing operations

1.9 complete and save relevant production/inspection data and documentation accurately

1.10 create and maintain management data and information to include the following:

a. production/inspection plans/delivery schedules

plus supporting documentation associated with three of the following

b. quality records/defects
c. problem history/resolution
d. resources/materials requisitions
e. budgets
f. equipment performance
g. equipment maintenance
h. equipment downtime/failure
i. equipment utilisation
j. health and safety
k. staff development and training
l. department procedures/work instructions
m. tests and trials
n. regulatory compliance

1.11 identify and lead on making improvements to processes and procedures

1.12 identify and implement improvements in the manufacturing/inspection department to achieve four of the following:

a. reduced production costs
b. reduced lead times
c. improved quality
d. improved equipment/tooling efficiency
e. improved staff utilisation
f. improved working practices
g. improved equipment downtime
h. improved equipment utilisation
i. improved use of production/inspection technologies
j. improved use of information technology
k. improved health and safety
l. improved visual management systems/documentation
m. improved resource planning
n. improved staff development and training
o. reduction in waste
p. reduction in energy usage
q. improved environmental impact
r. improved customer service
s. other (to be specified)

1.13 ensure manufacturing/inspection activities are carried out correctly in line with agreed company processes and procedures

1.14 ensure manufactured products comply with three of the following:

a. organisational guidelines and procedures

b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

1.15 create and update visual management documentation and systems to support the activities of the department

1.16 complete the relevant documentation to include one from the following:
a. job cards
b. company-specific production recording system

1.17 report and evaluate the impact of improvement activities

1.18 produce and maintain departmental competency skills matrix of team members

Learning outcome
The learner will: 2. understand how to lead mechanical manufacturing or inspection activities
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the mechanical manufacturing/inspection activity is to take place, and the responsibility these requirements place on them 2.2 explain the information systems that are in use within their organisation, and how to record data to the system 2.3 explain how to obtain and interpret legislative and regulatory documentation 2.4 explain how to obtain and interpret company policies and procedures 2.5 explain how to prioritise their own and their team's workload to ensure that targets are met 2.6 explain the process to be followed to develop and gain agreement on departmental budgets 2.7 explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out 2.8 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.9 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to manufacture or inspect the products/components to the required standards 2.10 explain how to access training and development programmes once a training need has been identified 2.11 explain the specific health and safety precautions to be applied during the manufacturing/inspection process and their effects on others 2.12 explain how to complete and review risk assessments 2.13 explain hazards associated with carrying out activities in the department (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and

equipment, not following laid-down procedures) and how to minimise these and reduce any risks

2.14 explain the importance of ensuring employees wear protective clothing and other appropriate safety equipment during manufacturing/inspection process

2.15 explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the manufacturing/inspection process

2.16 explain how to interpret drawings, charts, specifications, information, data, reports, manuals and other documents needed to understand the requirements of the manufacturing/inspection activity

2.17 explain how interpret changes to the requirements for the manufacturing/inspection activities

2.18 explain who to contact for clarification of the manufacturing/inspection requirements

2.19 explain who should be involved in authorising any changes required to manufacturing/inspection activities

2.20 explain the operating principles and processes of the manufacturing/inspection equipment used in their area of responsibility

2.21 explain the manufacturing/inspection methods that could be used for different types of processes or activity

2.22 explain the different types of equipment, and how they should be used for various manufacturing/inspection methods

2.23 explain how to determine the resources that are required for the manufacturing activities

2.24 explain the methods used to calculate how long it should take to complete specific work outputs

2.25 explain the procedure for purchasing/obtaining materials and other consumables necessary for the manufacturing/inspection activities

2.26 explain the company policy on repair/replacement of equipment required to manufacture/inspect products efficiently and effectively

2.27 explain the importance of keeping up to date with new technologies, manufacturing/inspection processes and systems

2.28 explain the common problems associated with the manufacturing/inspection activity

2.29 explain the quality criteria that must be used for the different products or process

2.30 explain the quality assurance and control methods that are used in the department

2.31 explain the personnel involved to ensure that the quality of product outcomes are fit for purpose and their responsibilities to ensure this is achieved

2.32 explain the tools and equipment used to ensure the products meet the customers quality requirements

2.33 explain the process and procedures to be followed when defective products are identified both during production/on completion of the manufacturing/inspection process

2.34 explain the organisational procedure(s) to be adopted for the safe disposal of all types of waste materials

2.35 explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement

2.36	explain how to use “root cause” problem solving analysis using the 5 whys/how technique
2.37	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.38	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.39	explain how to create, review and modify standard operating procedures (sop’s) and correlate work activities into them.
2.40	explain the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.41	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 456 Lead Installation or Commissioning Activities

UAN:	**J/505/0966**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 36 Leading installation or commissioning activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead an installation or commissioning team, including agreeing and monitoring departmental budgets, developing and updating installation/commissioning schedules and plans in accordance with approved procedures and policies, to ensure that the products installed or commissioned are fit for purpose and meet the required quality specification on time and to budget. The learner will also be required to ensure that the team have the appropriate skills knowledge and understanding required to install or commission the equipment or components in the area they have responsibility for. The learner will also be required to identify and implement a systematic approach to improving the installation or commissioning activities undertaken. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation or commissioning activities undertaken, and to report any problems with the activities that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner must ensure that that all necessary data, documentation is completed accurately and legibly and stored in the correct location and format.

The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work carried out by the installation or commissioning team.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying a range of leadership methods and techniques to ensure that the products installed and commissioned are fit for purpose and meet the quality specification on time and to budget. The learner will know about the tools and equipment and consumables required in an adequate depth to provide a sound basis for leading the installation or commissioning activities. In addition, the learner will have sufficient knowledge on how to develop the installation or commissioning team and how to identify and implement a systematic approach to improving the installation or commissioning activities undertaken

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The learner will understand the safety precautions required when carrying out the installation or commissioning activities. The learner will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. lead installation or commissioning activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead the installation or commissioning team by carrying out all the following: a. obtain accurate details of the products to be installed or commissioned b. review and interpret the product specification and documentation to assess their characteristics and requirements c. clarify any aspects of the product specification or timescales that are unclear d. communicate the installation or commissioning activities to be undertaken with the team e. involve the team in planning how the installation or

commissioning activities will be achieved

f. provide clear and accurate instructions to all the relevant people
g. secure, monitor and control the use of resources to achieve the most effective results
h. confirm and communicate any changes to the product specification and/or timescales required by the customer
i. allocate specific jobs/tasks to each team member
j. motivate the team to present their own ideas on improvements that could be made to the installation or commissioning processes and procedures
k. encourage the team and/or individuals to take the lead where appropriate
l. deal efficiently and effectively with problems affecting installation or commissioning activity
m. produce and agree contingency plans when required
n. ensure that the work area will be accessible, free from obstructions or hazards, and suitably prepared for the installation/commissioning to take place
o. ensure that appropriate utilities will be available (such as gas, water, air, electricity)
p. obtain clearance to carry out the installation or commissioning activities
q. confirm that everyone involved accepts the equipment or components are in a satisfactory condition for handover to take place with the customer
r. confirm the handover date with the customer and the precise moment of transfer of responsibility

1.3 develop, gain agreement and review installation/commissioning departmental budgets

1.4 produce, agree and update departmental installation/commissioning schedules and plans

1.5 ensure that schedules and plans are capable of meeting all relevant outputs required

1.6 lead installation/commissioning activities within the department

1.7 lead the installation or commissioning activities for one of the following:

a. mechanical equipment
b. electrical/electronic equipment
c. equipment to produce an engineered system
d. instrumentation and control equipment
e. fluid power equipment
f. fabricated and welded components/assemblies
g. process controller equipment
h. production lines and equipment
i. emergency electrical power generation equipment
j. environmental pollution control equipment
k. workplace environmental control equipment
l. workplace access control equipment
m. heating and ventilation equipment
n. air conditioning and ventilation equipment
o. compressed air equipment

p. waste/foul water distribution equipment
q. fresh water distribution equipment
r. refrigeration equipment
s. composite components and assemblies
t. lift/escalator components and assemblies
u. aircraft components and assemblies
v. marine components and assemblies
w. automotive components and assemblies
x. other equipment/components (to be specified)

1.8 complete and save relevant installation/commissioning data and documentation accurately

1.9 create and maintain management data and information to include the following:

a. installation or commissioning plans/delivery schedules

plus supporting documentation associated with three of the following

b. quality records/defects
c. problem history/resolution
d. resources/materials requisitions
e. budgets
f. equipment performance
g. equipment maintenance
h. equipment downtime/failure
i. equipment utilisation
j. health and safety
k. staff development and training
l. department procedures/work instructions
m. tests and trials
n. regulatory compliance

1.10 identify and lead on making improvements to processes and procedures

1.11 identify and implement improvements in the installation or commissioning activity to achieve four of the following:

a. reduced costs
b. reduced lead times
c. improved quality
d. improved equipment/tooling efficiency
e. improved staff utilisation
f. improved working practices
g. improved equipment downtime
h. improved equipment utilisation
i. improved use of new installation/commissioning technologies
j. improved use of information technology
k. improved health and safety
l. improved visual management systems/documentation
m. improved resource planning
n. improved staff development and training
o. reduction in waste
p. reduction in energy usage
q. improved environmental impact

r. improved customer service
s. other (to be specified)

1.12 ensure installation/commissioning activities are carried out correctly in line with agreed company processes and procedures

1.13 ensure manufactured products comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

1.14 create and update visual management documentation and systems to support the activities of the department

1.15 complete the relevant documentation to include one from the following:
a. job cards
b. company-specific production recording system

1.16 report and evaluate the impact of improvement activities

1.17 produce and maintain departmental competency skills matrix of team members

1.18 obtain operational information from three of the following:
a. design office
b. industrial engineering
c. quality engineering
d. process engineering
e. production engineering
f. company information systems
g. customer
h. sales department
i. component/product manufacturers
j. material/component supplier
k. other (to be specified)

Learning outcome

The learner will:

2. understand how to lead installation or commissioning activities

Assessment criteria

The learner can:

2.1 explain the health and safety requirements of the area in which the installation/commissioning activity is to take place, and the responsibility these requirements place on them

2.2 explain the information systems that are in use within their organisation and how to record data to the system

2.3 explain how to obtain and interpret legislative and regulatory documentation

2.4 explain how to obtain and interpret company policies and procedures

2.5 explain how to prioritise their own and their team's workload to ensure that targets are met

2.6	explain the process to be followed to develop and gain agreement on departmental budgets
2.7	explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out
2.8	explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
2.9	explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to install/commission equipment or components to the required standards
2.10	explain how to access training and development programmes once a training need has been identified
2.11	explain the specific health and safety precautions to be applied during the installation or commissioning activity and their effects on others
2.12	explain how to complete and review risk assessments
2.13	explain the hazards associated with carrying out installation or commissioning activities in the department (such as handling oils, greases, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down procedures) and how to minimise these and reduce any risks
2.14	explain the importance of ensuring employees wear protective clothing and other appropriate safety equipment during installation or commissioning process
2.15	explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the installation or commissioning process
2.16	explain how to interpret drawings, charts, specifications, information, data, reports, manuals and other documents needed to understand the requirements of the installation or commissioning activity
2.17	explain how interpret changes to the requirements for the installation or commissioning activities
2.18	explain who to contact for clarification of the installation or commissioning requirements
2.19	explain who should be involved in authorising any changes required to installation or commissioning activities
2.20	explain the operating principles and processes of the installed or commissioned equipment or components in their area of responsibility
2.21	explain the installation or commissioning methods used for different types of equipment or components
2.22	explain the different types of tools and equipment used in the installation or commissioning activity and how they should be used
2.23	explain how to determine the resources that are required for the installation or commissioning activity
2.24	explain the methods used to calculate how long it should take to complete specific work outputs
2.25	explain the procedure for purchasing/obtaining materials and other consumables necessary for the installation or commissioning activities
2.26	explain the company policy on repair/replacement of equipment required to support the installation or commissioning activity

efficiently and effectively

2.27 explain the importance of keeping up to date with new technologies and tools and equipment used to install or commission equipment or components

2.28 explain the common problems associated with the installation or commissioning activity

2.29 explain the quality criteria that must be used for the different products or processes

2.30 explain the quality assurance and control methods that are used in the department

2.31 explain the personnel involved to ensure that the quality of equipment or product installations are fit for purpose and their responsibilities to ensure this is achieved

2.32 explain the process and procedures to be followed when defective products are identified both during and on completion of the installation or commissioning process

2.33 explain the organisational procedure(s) to be adopted for the safe disposal of all types of waste materials

2.34 explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement

2.35 explain how to use "root cause" problem solving analysis using the 5 whys/how technique

2.36 explain how to evaluate improvement ideas in order to select those that are to be pursued

2.37 explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process

2.38 explain how to create, review and modify standard operating procedures (sop's) and correlate work activities into them

2.39 explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)

2.40 explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 457 Lead Electrical/Electronic Product Manufacturing or Testing Activities

UAN:	**Y/505/0969**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 39 Leading electrical/electronic product manufacturing or testing activities (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead an electrical/electronic manufacturing or test team, including agreeing and monitoring departmental budgets, developing and updating production/test schedules and plans in accordance with approved procedures and policies, to ensure that the products manufactured are fit for purpose and meet the required quality specification on time and to budget. The learner will also be required to ensure that the team have the appropriate skills knowledge and understanding required to produce the products required in the manufacturing area they have responsibility for. The learner will also be required to identify and implement a systematic approach to improving the manufacturing activities undertaken. Their responsibilities will require them to comply with organisational policy and procedures for the electrical/electronic manufacturing/testing activities undertaken, and to report any problems with the activities that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner must

ensure that that all necessary data, documentation is completed accurately and legibly and stored in the correct location and format. They will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work carried out by the electrical/electronic manufacturing/test team.

Their underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying a range of leadership methods and techniques to ensure that the products manufactured/tested are fit for purpose and meet the quality specification on time and to budget. The learner will know about the equipment, tooling and consumables required in an adequate depth to provide a sound basis for leading the electrical/electronic manufacturing/testing activities. In addition, they will have sufficient knowledge on how to develop the manufacturing/test team and how to identify and implement a systematic approach to improving the manufacturing activities undertaken.

The learner will understand the safety precautions required when carrying out the electrical/electronic manufacturing/testing activities. They will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. lead electrical/electronic product manufacturing or testing activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead the electrical/electronic manufacturing team by carrying out all the following: a. obtain accurate details of the products to be manufactured/tested b. review and interpret the product specification and documentation to assess their characteristics and requirements c. clarify any aspects of the product specification or timescales that are unclear

d. communicate the manufacturing/testing activities to be undertaken with the team
e. involve the team in planning how the manufacturing/testing activities will be achieved
f. provide clear and accurate instructions to all the relevant people
g. secure, monitor and control the use of resources to achieve the most effective results
h. confirm and communicate any changes to the product specification and/or timescales required by the customer
i. allocate specific jobs/tasks to each team member
j. motivate the team to present their own ideas on improvements that could be made to the manufacturing process and procedures
k. encourage the team and/or individuals to take the lead where appropriate
l. deal efficiently and effectively with problems affecting production output
m. produce and agree contingency plans when required

1.3 develop, gain agreement and review manufacturing/test departmental budgets

1.4 obtain operational information from three of the following:
a. design office
b. industrial engineering
c. quality engineering
d. process engineering
e. production engineering
f. company information systems
g. customer
h. sales department
i. component/product manufacturers
j. material/component supplier
k. other (to be specified)

1.5 produce, agree and update departmental production/test schedules and plans

1.6 ensure that schedules and plans are capable of meeting all relevant requirements

1.7 lead electrical/electronic manufacturing/test activities within the department

1.8 lead electrical/electronic manufacturing/testing activities for one of the following:
a. printed circuit board manufacture
b. electronic component manufacture
c. semi conductor manufacture
d. electronic control unit manufacture
e. testing electronic products/components
f. transformer and inductor manufacture
g. electrical motor and generator manufacture
h. electrical control system and equipment manufacture
i. instrumentation and control equipment manufacture
j. cable forms and loom manufacture
k. testing electrical equipment and systems

l. other product/component manufacturing/processing operations (to be specified)

1.9 complete and save relevant production/test data and documentation accurately

1.10 identify and lead on making improvements to processes and procedures

1.11 identify and implement improvements in the manufacturing department to achieve four of the following:

a. reduced production costs
b. reduced lead times
c. improved quality
d. improved equipment/tooling efficiency
e. improved staff utilisation
f. improved working practices
g. improved equipment downtime
h. improved equipment utilisation
i. improved use of production technologies
j. improved use of information technology
k. improved health and safety
l. improved visual management systems/documentation
m. improved resource planning
n. improved staff development and training
o. reduction in waste
p. reduction in energy usage
q. improved environmental impact
r. improved customer service
s. other (to be specified)

1.12 ensure manufacturing/test activities are carried out correctly in line with agreed company processes and procedures

1.13 ensure manufactured products complies with three of the following:

a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

1.14 create and update visual management documentation and systems to support the activities of the department

1.15 create and maintain management data and information to include the following:

a. production or testing planning/delivery schedules

plus supporting documentation associated with three of the following

b. quality records/defects
c. problem history/resolution
d. resources/materials requisitions
e. budgets
f. equipment performance
g. equipment maintenance
h. equipment downtime/failure

i. equipment utilisation
j. health and safety
k. staff development and training
l. department procedures/work instructions
m. tests and trials
n. regulatory compliance

1.16 report and evaluate the impact of improvement activities

1.17 complete the relevant documentation to include one from the following:
a. job cards
b. company-specific production recording system

1.18 produce and maintain departmental competency skills matrix of team members

Learning outcome
The learner will: 2. understand how to lead electrical/electronic product manufacturing or testing activities
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the electrical/electronic manufacturing/testing activity is to take place, and the responsibility these requirements place on them 2.2 explain the information systems that are in use within their organisation, and how to record data to the system 2.3 explain how to obtain and interpret legislative and regulatory documentation 2.4 explain how to obtain and interpret company policies and procedures 2.5 explain how to prioritise their own and their team's workload to ensure that targets are met 2.6 explain the process to be followed to develop and gain agreement on departmental budgets 2.7 explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out 2.8 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.9 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to manufacture/test the equipment to the required standards 2.10 explain how to access training and development programmes once a training need has been identified 2.11 explain the specific health and safety precautions to be applied during the manufacturing/testing process, and their effects on others 2.12 explain the procedure for completing and reviewing risk assessments 2.13 explain the hazards associated with carrying out activities in the department and how to minimise these and reduce any risks 2.14 explain the importance of ensuring employees wear protective

clothing and other appropriate safety equipment during manufacturing/testing process

2.15 explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the manufacturing/testing process

2.16 explain how to interpret drawings, charts, specifications, information, data, reports, manuals and other documents needed to understand the requirements of the manufacturing/testing activity

2.17 explain how interpret changes to the requirements for the manufacturing/testing activities

2.18 explain who to contact for clarification of the manufacturing/testing requirements

2.19 explain who should be involved in authorising any changes required to manufacturing/testing activities

2.20 explain the operating principles and processes of the manufacturing/testing equipment used in their area of responsibility

2.21 explain the manufacturing/testing methods that could be used for different types of processes or activity

2.22 explain the different types of equipment, and how they should be used for various manufacturing/testing methods

2.23 explain how to determine the resources that are required for the manufacturing/testing activities

2.24 explain the methods used to calculate how long it should take to complete specific work outputs

2.25 explain the procedure for purchasing/obtaining materials and other consumables necessary for the manufacturing/testing activities

2.26 explain the company policy on repair/replacement of equipment required to manufacture/test products efficiently and effectively

2.27 explain the importance of keeping up to date with new technologies, manufacturing/testing processes and systems

2.28 explain the common problems associated with the manufacturing/testing activity.

2.29 explain the quality criteria that must be used for the different products or process

2.30 explain the quality assurance and control methods that are used in the department

2.31 explain the personnel involved to ensure that the quality of product outcomes are fit for purpose and their responsibilities to ensure this is achieved

2.32 explain the tools and equipment used to ensure the products meet the customers quality requirements

2.33 explain the process and procedures to be followed when defective products are identified both during production/on completion of the manufacturing/testing process

2.34 explain the organisational procedure(s) to be adopted for the safe disposal of all types of waste materials

2.35 explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement

2.36 explain how to use "root cause" problem solving analysis using the 5 whys/how technique

2.37 explain how to evaluate improvement ideas in order to select those

	that are to be pursued
2.38	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.39	explain how to create, review and modify standard operating procedures (sop's) and correlate work activities into them
2.40	explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.41	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 458 Carry out the Testing and Calibration of Instrumentation Control Equipment and Circuits

UAN:	**L/505/0970**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 40 Carrying out the testing and calibration of instrumentation control equipment and circuits (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead and carry out tests and calibration of instrumentation and control equipment and circuits, in accordance with approved procedures. The learner will be required to carry out the various tests and calibration on a range of instrumentation equipment, such as pressure, flow, level and temperature instruments; fiscal monitoring equipment; smoke, heat, gas, water, chemical and metal detection and alarm systems; industrial weighing systems; linear and rotational speed measurement and control; vibration monitoring equipment; photo-optic instruments; nucleonic and radiation measurement; analysers recorders and indicators; telemetry systems; emergency shutdown systems and other specific instrumentation, to establish that they are functioning at optimal level and to specification. The learner will be required to carry out tests and calibration which will include voltage and current levels, resistance values, waveform, open/short circuit, signal injection, logic state, pressure/leak tests, signal measurement and transmission and other specific or special-to-type tests.

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

The learner's underpinning knowledge will provide an in depth understanding of the procedures for carrying out the required tests and calibration, and will provide an informed approach to applying the necessary testing and calibrating procedures. The learner will understand the equipment being worked on, the test and calibration equipment being used, and the various testing/calibrating procedures and their application, in adequate depth to provide a sound basis for carrying out the activities to the required specification and remains compliant with all standards and regulations. In addition, the learner will be expected to review the outcome of the tests/calibration, to compare the results with appropriate specifications, to determine the action required, and to record/report the results in the appropriate format.

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

Learning outcome
The learner will: 1. carry out the testing and calibration of instrumentation control equipment and circuits
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 carry out all of the following during the testing and calibration activities:

a. obtain and use the correct issue of company and/or manufacturers' drawings and testing/calibration documentation
b. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
c. where appropriate, ensure the insertion of any relevant system trip defeats (such as fire extinguishant, emergency shutdown)
d. ensure the safe isolation of instruments (such as process, electrical, hydraulic, pneumatic, mechanical)
e. ensure that test equipment used is appropriate for the tests being carried out, is within current calibration dates and is used within its specified range
f. provide and maintain safe access and working arrangements for the testing and calibration area
g. carry out the testing and calibration activities, using appropriate techniques and procedures
h. where applicable, take electrostatic discharge (ESD) precautions when handling sensitive components and circuit boards
i. re-connect and return the equipment to service on completion of the testing and calibration activities
j. dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition

1.3 lead a team by carrying out all the following:
a. communicate the testing/calibration activities to the team
b. involve the team in planning how the testing/calibration activities will be undertaken
c. allocate specific testing/calibration activities to each team member
d. involve the team in identifying improvements that could be made to the testing/calibration process and/or procedures
e. encourage the team and/or individuals to take the lead where appropriate

1.4 produce and update relevant testing/calibration schedules and plans

1.5 review and update procedures and plans to include three the following:
a. preventive testing/calibration (routine inspections, and adjustments)
b. corrective testing/calibration (activities identified from preventative maintenance activities)
c. predictive testing/calibration (analysis of the equipment's condition)
d. reactive testing/calibration (unexpected equipment/component failure)
e. maintenance prevention (equipment/component design and development)

plus supporting documentation associated with two of the following
f. equipment performance
g. equipment downtime/failure

h. overall equipment effectiveness (OEE)
i. maintenance costs
j. health and safety
k. staff development and training
l. maintenance procedures/instructions
m. testing/calibration processes
n. operator manuals/working instructions
o. regulatory compliance

1.6 lead testing/calibration activities within the limits of their personal authority

1.7 carry out tests and calibration on four of the following types of instrumentation control equipment and circuits:

a. pressure (such as absolute, gauge, vacuum)
b. flow (such as orifice plate, venturi tube, electromagnetic, ultrasonic, differential pressure cell, positive displacement)
c. level (such as floats, displacer, differential pressure cells, load cells, ultrasonic, conductivity)
d. temperature (such as bi-metallic, thermocouples, resistance, infra-red, thermal imaging)
e. weight (such as mechanical systems, load cells/strain gauges, transducers)
f. fiscal metering (such as gas, electricity, water, fuel)
g. detection and alarm (such as smoke, heat, gas, chemical, water, metal)
h. speed measurement (such as mechanical, electrical, stroboscopic)
i. emergency shutdown
j. speed control (such as mechanical governors, electrical governors, DC speed controller, AC motor control systems, stepper motors, invertors)
k. vibration monitoring (such as vibration switches, proximity probes, seismic velocity transducer, linear variable differential transformers, portable data collectors)
l. nucleonic and radiation (such as Geiger-Muller tube, neutron counter, photomultiplier tube, proportional counter, ionising radiation monitors)
m. analysers (such as gas detection, spectroscopy, oxygen analyser, water analysis, moisture measurement, density)
n. recorders and indicators
o. telemetry systems (such as master station, outstation, stand alone systems)
p. valves and valve mechanisms (such as control valves, valve actuators and positioners)
q. other specific instrumentation

1.8 carry out tests and calibration using a range of tools and test equipment, to include six of the following:

a. multimeter
b. insulation testers
c. temperature baths
d. signal sources
e. standard test gauges
f. calibrated weights

g. current injection devices
h. pressure sources
i. comparators
j. analogue and digital meters
k. digital pressure indicators
l. dead weight tester
m. logic probes
n. calibrated flow meters
o. special purpose test equipment
p. workshop potentiometers

1.9 carry out all of the following during the testing/calibrating activities:
a. obtaining calibration parameters from data records
b. installing alarm defeat keys or program overrides (where appropriate)
c. connecting up supplies, test and calibration equipment
d. carrying out the tests and calibration to manufacturers' procedures
e. setting, adjusting and calibrating the equipment and control circuit to the required specification parameters
f. recording the test and calibration results in the appropriate formats/documentation
g. dealing with instruments and control circuits that do not meet specification requirements

1.10 carry out six of the following tests and calibrations:
a. visual inspection of the instrument for completeness and freedom from damage or foreign objects
b. standard serviceability test/calibration
c. equipment self-diagnostics
d. leak/pressure test
e. signal injection tests
f. soak test
g. special-to-type tests
h. signal measurement and transmission
i. operational/function checks
j. five point calibration
k. unit substitution

1.11 test and calibrate instrumentation control equipment and circuits, in compliance with three of the following
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

1.12 carry out the testing/calibration activities in the specified sequence and in an agreed timescale

1.13 report any instances where the testing/calibration activities cannot be fully met or where there are identified defects outside the planned schedule

1.14 complete relevant testing/calibration documentation accurately

1.15 complete the relevant testing/calibration documentation to include

one from the following:

a. job cards
b. testing/calibration log or report
c. company-specific recording system

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

1.17 identify and lead on making improvements to testing/calibration processes and procedures

1.18 identify and implement improvements in the services provided by the team to include two of the following:

a. equipment downtime during testing and calibration
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. testing and calibration procedures
e. testing/calibration processes
f. operator instructions
g. visual management systems/documentation
h. resource planning
i. costs
j. staff development and training
k. health and safety
l. procurement
m. other (to be specified)

1.19 update management information and systems to support the activities of the department

Learning outcome
The learner will: 2. understand how to carry out the testing and calibration of instrumentation control equipment and circuits
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the testing/calibration activity is to take place, and the responsibility these requirements place on them 2.2 explain how to prioritise their own and their team's workload to ensure that targets are met 2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to test and calibrate equipment to the required standards 2.5 explain how to complete a skills audit of team members 2.6 explain how teams can access the appropriate training and development programmes once a need training need has been identified 2.7 explain the isolation and lock-off procedure or permit-to-work procedure that applies to the system and instruments being worked on, and how to check that any stored energy in pipework and instruments has been released

2.8	explain the specific safety precautions to be taken when carrying out instrument and circuit testing and calibration activities
2.9	explain hazards associated with carrying out testing and calibrating activities on instrumentation and control systems (such as stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down testing and calibration procedures) and how to minimise them and reduce any risks
2.10	explain the importance of wearing protective clothing and other appropriate safety equipment, during the testing and calibrating activities
2.11	explain how the testing and calibrating activities may affect the work of others and the procedure for informing them of the work to be carried out
2.12	explain the procedures and precautions to be adopted to eliminate/protect against electrostatic discharge (esd)
2.13	explain how to obtain and interpret circuit drawings, calibration data, instrument specifications, manufacturers' manuals, history/maintenance reports, symbols used on instrumentation and control documents, and other documents needed in the testing and calibration process
2.14	explain the basic principles of operation of the instrumentation and control equipment being tested/calibrated, how the system functions, its operating sequence, the working purpose of individual units/components and how they interact
2.15	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
2.16	explain the identification of instrument sensors (including how to identify their markings, calibration information, component values, operating parameters and working range)
2.17	explain methods of checking and calibrating instruments, and the type and range of equipment that can be used
2.18	explain how to set up and apply the appropriate test and calibration equipment (such as pressure testing in incremental stages)
2.19	explain how to check that the test and calibration equipment is free from damage or defects, is in a safe and usable condition, and is configured correctly for the intended purpose
2.20	explain how to analyse the test and calibration results, and how to use comparison and sequential techniques
2.21	explain the environmental control requirements and company operating procedures relating to the testing and calibrating activities
2.22	explain the documentation required, and the procedures to be followed, at the conclusion of the testing and calibrating
2.23	explain the documentation required, and the procedures to be followed, at the conclusion of the testing and calibrating
2.24	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.25	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.26	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process

2.27	explain how to create or update standard operating procedures (sop's), testing and calibration schedules and plans
2.28	explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.29	explain the extent of their own authority and to whom they should report if they have problems that they cannot resolve

Unit 459 Carry out Maintenance Activities on Mechanical Equipment

UAN:	**R/505/0971**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 41 Carrying out maintenance activities on mechanical equipment (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on mechanical equipment, in accordance with approved procedures. As part of the team the learner will be required to maintain a range of mechanical equipment. This will involve dismantling, removing and replacing faulty equipment at component or unit level on a variety of different types of mechanical assemblies and sub-assemblies. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. The learner will be expected to apply a range of dismantling and assembling methods and techniques, such as proof marking to aid reassembly, dismantling components requiring pressure or expansion/contraction techniques, setting, aligning and adjusting components, torque loading components and making 'off-load' checks before starting up the maintained equipment.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities or the tools and equipment used, that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment, and materials used in the maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying mechanical maintenance procedures. The learner will understand the dismantling and reassembly methods and procedures, and their application. The learner will know how the equipment functions and the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and ensuring the repaired equipment functions to the required specification and remains compliant with all standards and regulations. In addition, the learner will have sufficient in-depth knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

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

Learning outcome
The learner will: 1. carry out maintenance activities on mechanical equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 carry out all of the following during the maintenance activity: a. obtain and use the correct issue of company and/or manufacturer's drawings and maintenance documentation b. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work c. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids) d. provide and maintain safe access and working arrangements for the maintenance area e. carry out the maintenance activities using appropriate techniques and procedures f. re-connect and return the system to service on completion of activities g. dispose of waste items in a safe and environmentally acceptable manner and leave the work area in a safe condition 1.3 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where appropriate 1.4 produce and update relevant maintenance schedules and plans 1.5 review and update maintenance procedures and plans to include three the following: a. preventive maintenance (routine inspections, and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities) c. predictive maintenance (analysis of the equipment's condition) d. reactive maintenance (unexpected equipment/component failure) e. maintenance prevention (equipment/component design and development) plus supporting documentation associated with two of the following f. equipment performance g. equipment downtime/failure h. overall equipment effectiveness (OEE) i. maintenance costs

j. health and safety
k. staff development and training
l. maintenance procedures/instructions
m. operator manuals/working instructions
n. regulatory compliance

1.6 lead maintenance activities within the limits of their personal authority

1.7 carry out the maintenance activities in the specified sequence and in an agreed timescale

1.8 collect evidence regarding the fault from three of the following sources:

a. person or operator who reported the fault
b. sensory input (such as sight, sound, smell, touch)
c. monitoring equipment or gauges
d. plant/machinery records
e. recording devices
f. condition of end product

1.9 use a range of fault diagnostic techniques, to include two of the following:

a. half-split technique
b. emergent sequence
c. unit substitution
d. input/output
e. function/performance testing
f. six point technique
g. injection and sampling
h. equipment self diagnostics

1.10 use a variety of diagnostic aids and equipment, to include two of the following:

a. manufacturer's manual
b. physical layout diagrams
c. algorithms
d. flow charts
e. probability charts/reports
f. fault analysis charts (such as fault trees)
g. equipment self diagnostics
h. trouble shooting guides

1.11 apply two of the following monitoring or testing procedures to help in the fault diagnosis:

a. alignment checks
b. force/pressure checks (such as spring pressure, hydraulic or pneumatic pressures)
c. leakage
d. vibration
e. thermal checks (such as bearings, friction surfaces)
f. movement checks (such as travel, clearance, levers, links)

1.12 use two of the following types of test equipment to aid fault diagnosis:

a. measuring instruments/devices
b. thermal indicators
c. dial test indicators

d. audio test devices
e. torque measuring devices
f. self-diagnostic equipment
g. other specific test equipment

1.13 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.14 carry out maintenance activities on three of the following types of equipment:
a. gearboxes
b. machine tools
c. lifting and handling equipment
d. processing plant
e. production plant
f. engines
g. pumps
h. process control valves
i. compressors
j. transfer equipment
k. mechanical structures
l. workholding devices
m. company-specific equipment

1.15 carry out six of the following maintenance techniques, as applicable to the equipment being maintained:
a. dismantling equipment to unit/sub-assembly level
b. dismantling units to component level
c. proof marking/labelling of components
d. checking components for serviceability
e. replacing all lifed items (such as seals, bearings, gaskets)
f. replacing damaged/defective components
g. setting, aligning and adjusting replaced components
h. tightening fastenings to the required torque
i. making 'off-load' checks before starting up
j. replenishing oils and greases
k. safety system checks
l. functionally testing the completed system

1.16 replace/refit a range of mechanical components, to include ten of the following:
a. shafts
b. couplings
c. gears
d. clutches
e. valves and seats
f. pistons
g. splined components
h. brakes
i. bearing and seals
j. fitting keys

k. springs
l. diaphragms
m. cams and followers
n. chains & sprockets
o. pulleys and belts
p. levers and links
q. slides
r. rollers
s. tooling
t. fluid storage units
u. fabricated components
v. wire ropes/cables
w. housings
x. actuating mechanisms
y. structural/operational components
z. locking & retaining devices (such as circlips, pins, lock nuts)
aa. covers and casings
bb. integrated modules
cc. other specific components

1.17 maintain mechanical equipment which complies with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.19 complete relevant maintenance documentation accurately

1.20 complete the relevant maintenance documentation to include one from the following:
a. job cards
b. permit to work/formal risk assessment and/or sign-on/off procedures
c. maintenance log or report
d. company-specific recording system

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

1.22 identify and lead on making improvements to maintenance processes and procedures

1.23 identify and implement improvements in the services provided by the maintenance team to include two of the following:
a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions
f. visual management systems/documentation
g. resource planning

h. costs
i. staff development and training
j. health and safety
k. procurement
l. other (to be specified)

1.24 update management information and systems to support the activities of the maintenance department

Learning outcome

The learner will:

2. understand how to carry out maintenance activities on mechanical equipment

Assessment criteria

The learner can:

2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them

2.2 explain how to prioritise their own and their team's workload to ensure that targets are met

2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards

2.5 explain how to complete a skills audit of team members

2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified

2.7 explain the isolation and lock-off procedures or permit-to-work procedure that applies

2.8 explain the specific health and safety precautions to be applied during the maintenance procedure and their effects on others

2.9 explain the hazards associated with carrying out mechanical maintenance activities (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risks

2.10 explain the importance of wearing protective clothing and other appropriate safety equipment during maintenance process

2.11 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process

2.12 explain the procedure to be adopted to establish the background of the fault

2.13 explain how to evaluate various types of information available for fault diagnosis (such as operator reports, monitoring equipment, sensory information, machinery history records and condition of end product)

2.14 explain 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)

2.15 explain how to use a range of fault diagnostic equipment to investigate the problem (such as measuring devices, torque and run-out devices)

2.16 explain how to use various items of test equipment, and how to calibrate it and check that it is free from damage and defects

2.17 explain how to evaluate sensory information (sight, sound, smell, touch)

2.18 explain the procedure(s) to be followed for investigating the faults, and how to deal with intermittent faults

2.19 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems

2.20 explain how to relate previous reports/records of similar fault conditions

2.21 explain how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system

2.22 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities

2.23 explain the company policy on repair/replacement of components during the maintenance process

2.24 explain the sequence to be adopted for the dismantling/re-assembly of various types of assemblies

2.25 explain the methods and techniques used to dismantle/assemble mechanical equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)

2.26 explain the methods of checking components are fit for purpose, and how to identify defects and wear characteristics

2.27 explain the basic principles of how the equipment functions, operation sequence, the working purpose of individual units/components and how they interact

2.28 explain the identification, application, fitting and removal of different types of bearings (such as roller, ring, thrust)

2.29 explain the methods and techniques of fitting keys and splined components

2.30 explain the identification, application, fitting and removal of different types of gears

2.31 explain how to correctly tension belts and chains

2.32 explain the identification and application of different types of locking devices

2.33 explain the methods of checking that removed components are fit for purpose, and the need to replace `lifed' items (such as seals, gaskets, belts)

2.34 explain the uses of measuring equipment (such as micrometers, verniers, run-out devices, other measuring devices)

2.35 explain how to make adjustments to components/assemblies to ensure they function correctly (such as setting working clearance, setting travel, setting backlash in gears, preloading bearings)

2.36 explain the importance of making `off-load' checks before running the equipment under power

2.37 explain how to check tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose

2.38	explain the importance of maintenance documentation and/or reports following the maintenance activity, and how to generate them
2.39	explain the equipment operating and control procedures to be applied during the maintenance activity
2.40	explain how to use lifting and handling equipment in the maintenance activity
2.41	explain the problems associated with the maintenance activity, and how they can be overcome
2.42	explain the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
2.43	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.44	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.45	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.46	explain how to create or update standard operating procedures (sop's) maintenance schedules and plans
2.47	explain the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.48	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 460 Carry out Maintenance Activities on Electrical Equipment

UAN:	**Y/505/0972**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 42 Carrying out maintenance activities on electrical equipment (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on electrical equipment, in accordance with approved procedures. As part of the team the learner will be required to maintain a range of electrical equipment. The learner will be required to maintain a range of electrical equipment, such as single, three-phase and direct current power supplies and control systems, motors and starters, switchgear and distribution panels, control systems, electrical equipment, wiring enclosures and luminaries. This will involve dismantling, removing and replacing faulty equipment, at component or unit level, on a variety of different types of electrical assemblies and sub-assemblies. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. The learner will be expected to apply a range of dismantling and reassembly methods and techniques, such as soldering, crimping, harnessing and securing cables and

components.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken and to report any problems with the maintenance activities or the tools and equipment used, that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment, and materials used in the maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide an in depth understanding of their work and will provide an informed approach to applying electrical maintenance procedures. The learner will understand the dismantling and reassembly methods and procedures, and their application. The learner will know about the electrical equipment worked on, component properties, functions and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and ensuring that the repaired equipment functions to the required specification and remains compliant with all standards and regulations.

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

Learning outcome
The learner will: 1. carry out maintenance activities on electrical equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where appropriate 1.3 carry out all of the following during the maintenance activity: a. obtain and use the correct issue of company and/or manufacturer's drawings and maintenance documentation b. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work c. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids) d. provide and maintain safe access and working arrangements for the maintenance area e. carry out the maintenance activities using appropriate techniques and procedures f. re-connect and return the system to service on completion of activities g. dispose of waste items in a safe and environmentally acceptable manner and leave the work area in a safe condition 1.4 produce and update relevant maintenance schedules and plans 1.5 review and update maintenance procedures and plans to include three of the following: a. preventive maintenance (routine inspections, and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities) c. predictive maintenance (analysis of the equipment's condition) d. reactive maintenance (unexpected equipment/component failure) e. maintenance prevention (equipment/component design and development) plus supporting documentation associated with two of the following f. equipment performance g. equipment downtime/failure h. overall equipment effectiveness (OEE) i. maintenance costs

j. health and safety
k. staff development and training
l. maintenance procedures/instructions
m. operator manuals/working instructions
n. regulatory compliance

1.6 lead maintenance activities within the limits of their personal authority

1.7 carry out the maintenance activities in the specified sequence and in an agreed timescale

1.8 collect fault diagnostic evidence from four of the following sources:
a. the person or operator who reported the fault
b. recording devices
c. test instrument measurements (such as watt meters, multimeter, earth-loop impedance testers)
d. sensory input (sight, sound, smell, touch)
e. plant/equipment records
f. circuit meters (such as voltmeter, power factor meter, ammeter)
g. condition of end product
h. equipment self-diagnostics

1.9 use a range of fault diagnostic techniques, to include two of the following:
a. half-split technique
b. input/output technique
c. emergent sequence
d. injection and sampling
e. unit substitution
f. six point technique
g. function/performance testing
h. equipment self-diagnostics

1.10 use a variety of diagnostic aids and equipment to include two of the following:
a. logic diagrams
b. equipment self-diagnosis
c. trouble shooting guides
d. flow charts or algorithms
e. fault analysis charts (such as fault trees)
f. electronic aids
g. manufacturers' manuals

1.11 use all of the following fault diagnosis procedures:
a. inspection (such as breakages, wear/deterioration, signs of overheating, missing parts, loose fittings)
b. operation (such as manual switching off and on, RCD test buttons, automatic switching/timing/sequencing, desired outputs)
c. measurement (such as voltage, current, continuity, power, temperature, luminescence)

1.12 use three of the following types of test equipment to aid fault diagnosis:
a. multimeter
b. watt meter

c. voltmeter
d. ammeter
e. earth-loop impedance tester
f. insulation resistance tester
g. portable appliance tester
h. light meter
i. other specific test equipment

1.13 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.14 carry out maintenance activities on six of the following types of electrical equipment:
a. single-phase power supplies
b. control systems and components
c. three-phase power supplies
d. electrical plant
e. direct current power supplies
f. wiring enclosures
g. motors and starters
h. luminaires
i. switchgear and distribution panels
j. other specific electrical equipment

1.15 carry out eight of the following maintenance activities as applicable to the equipment being maintained:
a. isolating and locking-off equipment
b. removing and replacing damaged wires and cables
c. disconnecting and reconnecting wires and cables
d. attaching suitable cable identification markers
e. removing and replacing wiring enclosures
f. removing electrical units/components
g. setting and adjusting replaced components
h. checking components for serviceability
i. making `off-load' checks before powering up
j. replacing damaged/defective components
k. functionally testing the completed system

1.16 replace/refit a range of electrical components, to include ten of the following groups of components:
a. cables and connectors
b. capacitors
c. lighting fixtures
d. contactors
e. rectifiers
f. batteries
g. relay components
h. encoders or resolvers
i. switches and sensors
j. overload protection devices
k. inverter and servo controllers

l. solenoids
m. locking and retaining devices (cable ties, clips, proprietary fasteners)
n. circuit boards
o. transformers
p. thermistors or thermocouples
q. other specific components

1.17 maintain electrical equipment which complies with one of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.19 complete relevant maintenance documentation accurately

1.20 complete the relevant maintenance documentation to include one from the following:
a. job cards
b. permit to work/formal risk assessment and/or sign-on/off procedures
c. maintenance log or report
d. company-specific recording system

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

1.22 identify and lead on making improvements to maintenance processes and procedures

1.23 update management information and systems to support the activities of the maintenance department

Learning outcome
The learner will: 2. understand how to carry out maintenance activities on electrical equipment
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them 2.2 explain how to prioritise their own and their team's workload to ensure that targets are met 2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards 2.5 explain how to complete a skills audit of team members 2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified 2.7 explain the isolation and lock-off procedure or permit-to-work procedure that applies to maintenance activities (such as electrical isolation, locking off switchgear, removal of fuses, placing of maintenance warning notices, proving the isolation has been achieved and secured) 2.8 explain how to recognise and deal with victims of electric shock 2.9 explain the hazards associated with carrying out electrical maintenance activities (such as contact with live electrical components, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risk 2.10 explain the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities 2.11 explain how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, wiring regulations, and other documents needed for the maintenance activities 2.12 explain the procedure to be adopted to establish the background of the fault 2.13 explain how to evaluate the various types of information available for fault diagnosis 2.14 explain how to use the various aids and reports available for fault diagnosis 2.15 explain how to use various items of fault diagnostic equipment to investigate the problem 2.16 explain the various fault finding techniques that can be used, and how they are applied (such as half-split, input-to-output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)

2.17 explain how to evaluate sensory information (sight, sound, smell, touch)

2.18 explain how to analyse evidence and evaluate possible characteristics and causes of specific faults/problems

2.19 explain how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system

2.20 explain how to relate previous reports/records of similar fault conditions

2.21 explain the care, handling and application of electrical test instruments (such as multimeters, insulation resistance testers)

2.22 explain how to calibrate electrical test instruments and check that they are free from damage and defects

2.23 explain the purpose of the components which have been replaced/maintained

2.24 explain the different types of cabling and their application (such as multicore cables, single core cables, steel wire armoured (swa), mineral insulated (mi), screened cables)

2.25 explain the application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)

2.26 explain the different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)

2.27 explain the care, handling and application of ohmmeters, multimeters and other electrical measuring instruments

2.28 explain the company policy on the repair/replacement of components, and the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities

2.29 explain how to check that the replacement components meet the required specification/operating conditions (such as values, tolerance, current carrying capacity, voltage rating, power rating, working temperature range, frequency)

2.30 explain the techniques used to dismantle/assemble electrical equipment (such as unplugging, de-soldering, removal of screwed, clamped and crimped connections)

2.31 explain the methods of removing and replacing cables and wires in wiring enclosures without causing damage to existing cables

2.32 explain the use of wiring regulations, and other, regulations when selecting wires and cables and when carrying out tests on systems

2.33 explain the methods of attaching identification markers/labels to removed components or cables to assist with re-assembly

2.34 explain the tools and equipment used in the maintenance activities (including the use of cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)

2.35 explain the methods of checking that components are fit for purpose, and the need to replace `lifed' items (such as motor brushes, seals and gaskets overload protection devices)

2.36 explain how to make adjustments to components/assemblies to ensure they function correctly

2.37 explain how to check tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose

2.38 explain the importance of making `off-load' checks before proving

	the equipment with the electrical supply on
2.39	explain the generation of maintenance documentation and/or reports following the maintenance activity
2.40	explain the equipment operating and control procedures to be applied during the maintenance activity
2.41	explain how to use appropriate lifting and handling equipment in the maintenance activity
2.42	explain the problems that can occur during the electrical maintenance activity, and how they can be overcome
2.43	explain the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
2.44	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.45	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.46	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.47	explain how to create or update standard operating procedures (sop's) maintenance schedules and plans.
2.48	explain the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.49	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 461 Carry out Maintenance Activities on Fluid Power Equipment

UAN:	**D/505/0973**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 43 Carrying out maintenance activities on fluid power equipment (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on fluid power equipment, in accordance with approved procedures. As part of the team the learner will be required to maintain a range of fluid power equipment. This will involve dismantling, removing and replacing faulty items, at component and unit level, on such as pumps, valves, actuators, sensors, intensifiers, regulators, compressors, pipes and hoses, and other specific fluid power equipment. This will involve depressurising the system, and removing, replacing and repairing system components, as applicable. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities or the tools and equipment used that they cannot personally resolve, or that are

outside their permitted authority, to the relevant people. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying maintenance procedures to fluid power equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions and the purpose of the individual components, their function and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activity, correcting faults and ensuring that the repaired equipment functions to the required specification and remains compliant with all standards and regulations. In addition, the learner will have sufficient depth of knowledge of the various components, to ensure they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly of the equipment.

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

Learning outcome
The learner will: 1. carry out maintenance activities on fluid power equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where

appropriate

1.3 produce and update relevant maintenance schedules and plans

1.4 review and update maintenance procedures and plans to include three the following:

a. preventive maintenance (routine inspections, and adjustments)
b. corrective maintenance (activities identified from preventative maintenance activities)
c. predictive maintenance (analysis of the equipment's condition)
d. reactive maintenance (unexpected equipment/component failure)
e. maintenance prevention (equipment/component design and development)

plus supporting documentation associated with two of the following

f. equipment performance
g. equipment downtime/failure
h. overall equipment effectiveness (OEE)
i. maintenance costs
j. health and safety
k. staff development and training
l. maintenance procedures/instructions
m. operator manuals/working instructions
n. regulatory compliance

1.5 lead maintenance activities within the limits of their personal authority

1.6 carry out the maintenance activities in the specified sequence and in an agreed timescale

1.7 collect fault diagnosis evidence from three of the following sources:

a. the person or operator who reported the fault
b. sensory input (such as sight, sound, smell, touch)
c. test instrument/rig measurements (such as pressure, flow, sequence)
d. plant/machinery records
e. monitoring equipment or gauges
f. condition of the end product
g. recording devices

1.8 use a range of fault diagnostic techniques, to include two of the following:

a. half-split technique
b. input/output
c. emergent sequence
d. injection and sampling
e. unit substitution
f. six point technique
g. functional/performance testing
h. equipment self-diagnostics

1.9 use a variety of diagnostic aids and equipment, to include two of the following:

a. manufacturer's manual
b. physical layout diagrams

c. algorithms
d. flow charts
e. probability charts/reports
f. fault analysis charts (such as fault trees)
g. equipment self-diagnostics
h. troubleshooting guides
i. sequence charts
j. function diagrams

1.10 use all of the following diagnostic procedures:
a. inspection (for leaks, loose fittings, breakages, wear/deterioration, damage to pipes/hoses, alignment)
b. operation (such as manual operation, timing, sequencing)
c. measurement (such as pressure, flow, timing, sequence, movement)

1.11 use two of the following types of test equipment to aid fault diagnosis:
a. measuring devices/meters
b. flow indicators
c. pressure indicators
d. thermal indicators
e. test rigs
f. self-diagnostic equipment
g. contamination monitoring and analysing devices

1.12 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.13 carry out all of the following during the maintenance activity:
a. obtain and use the correct issue of company and/or manufacturer's drawings and maintenance documentation
b. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
c. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
d. provide and maintain safe access and working arrangements for the maintenance area
e. carry out the maintenance activities using appropriate techniques and procedures
f. re-connect and return the system to service on completion of activities
g. dispose of waste items in a safe and environmentally acceptable manner and leave the work area in a safe condition

1.14 carry out maintenance activities on two of the following types of fluid power equipment:
a. pneumatic
b. hydraulic
c. vacuum

1.15 carry out all of the following maintenance activities, as applicable to the equipment being maintained:

a. chocking/supporting actuators/rams/component
b. releasing stored pressure
c. draining, removing and replacing oil/fluids (as applicable)
d. replacing damaged/defective components
e. removing and replacing units/components (such as pumps, valves, actuators)
f. disconnecting/removing hoses, pipes and tubing
g. replacing all `lifed' items (such as seals, filters, gaskets, hoses)
h. proof marking/labelling of removed components
i. checking components for serviceability
j. tightening fastenings to the required torque
k. setting, aligning and adjusting replaced components
l. making `off-load' checks before re-pressurising the system
m. functional/performance testing of the maintained system
n. priming and bleeding the system (where applicable)

1.16 carry out maintenance activities to component level on all of the following fluid power components:
a. pumps
b. valves
c. cylinders
d. actuators

1.17 replace/refit a range of fluid power components, to include ten of the following:
a. pumps
b. motors
c. compressors
d. sensors
e. pistons
f. bearings
g. receivers
h. lubricators/filters
i. spools
j. reservoirs
k. gaskets and seals
l. regulators
m. valves
n. accumulators
o. pipework, hoses/tubing
p. valve solenoid
q. actuators/cylinders
r. pressure intensifiers
s. switches
t. other specific components

1.18 maintain equipment which complies with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.20 complete relevant maintenance documentation accurately

1.21 complete the relevant maintenance documentation to include one from the following:

a. job cards
b. permit to work/formal risk assessment and/or sign-on/off procedures
c. maintenance log or report
d. company-specific recording system

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

1.23 identify and lead on making improvements to maintenance processes and procedures

1.24 identify and implement improvements in the services provided by the maintenance team to include two of the following:

a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions
f. visual management systems/documentation
g. resource planning
h. costs
i. staff development and training
j. health and safety
k. procurement
l. other (to be specified)

1.25 update management information and systems to support the activities of the maintenance department

Learning outcome

The learner will:

2. understand how to carry out maintenance activities on fluid power equipment

Assessment criteria

The learner can:

2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them

2.2 explain how to prioritise their own and their team's workload to ensure that targets are met

2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards

2.5 explain how to complete a skills audit of team members

2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need

has been identified

2.7 explain the isolation and lock-off procedures or permit-to-work procedure that applies

2.8 explain the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others

2.9 explain hazards associated with carrying out mechanical maintenance activities (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise these and reduce any risks

2.10 explain the importance of wearing protective clothing and other appropriate safety equipment during maintenance process

2.11 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process

2.12 explain 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, functional testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)

2.13 explain the procedure to be adopted to establish the background of the fault

2.14 explain how to evaluate the various types of information available for fault diagnosis

2.15 explain how to use the various aids and reports available for fault diagnosis

2.16 explain how to evaluate sensory information from sight, sound, smell, touch

2.17 explain how to use a range of fault diagnostic equipment to investigate the problem (such as measuring devices, pressure and flow testing devices)

2.18 explain the importance of checking that test equipment is within current calibration dates, and the procedure to get the test instruments correctly calibrated

2.19 explain how to use the test equipment, and how to connect it into the circuit at the appropriate points

2.20 explain how to relate previous reports/records of similar fault conditions

2.21 explain how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system

2.22 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities

2.23 explain principles and theories associated with fluid power equipment (such as cascading and truth tables, logic/ladder diagrams)

2.24 explain the basic principles of operation of the equipment to be maintained

2.25 explain company policy on repair/replacement of components during maintenance process

2.26 explain how to construct and apply ladder logic, sequential charts/tables or functional diagrams

2.27 explain dry and lubricated systems, and their application

2.28 explain the selection, types and characteristics of fluids for the system
2.29 explain the effects of pressure and flow on the performance of the system
2.30 explain the identification of different compressors (such as screw, piston, rotary, vane)
2.31 explain the identification of different hydraulic pumps and motors (such as piston, gear, vane)
2.32 explain how to determine pressure settings and their effect on the system
2.33 explain the different types of pipework, fittings and manifolds, and their application
2.34 explain the identification, application, function and operation of different types of valves, sensors, actuators, cylinders and pumps
2.35 explain the application and fitting of static and dynamic seals
2.36 explain the recognition of contaminants and the problems they can create, and the effects and likely symptoms of contamination in the system
2.37 explain the techniques used to dismantle/assemble fluid power equipment (release of pressures/force, proof marking, extraction)
2.38 explain the methods of checking that components are fit for purpose
2.39 explain how to make adjustments to components/assemblies to ensure that they function correctly
2.40 explain the identification and working purpose of individual components, and how they interact
2.41 explain how to check that tools and equipment are free from damage or defect, are in a safe and usable condition, and are configured correctly for the intended purpose
2.42 explain the generation of maintenance documentation and/or reports following the maintenance activity
2.43 explain the equipment operating and control procedures to be applied during the maintenance activity
2.44 explain how to use lifting and handling equipment safely and correctly in the maintenance activity
2.45 explain the problems associated with the maintenance activity, and how they can be overcome
2.46 explain the procedure to be adopted for the safe disposal of waste of all types of materials
2.47 explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.48 explain how to evaluate improvement ideas in order to select those that are to be pursued
2.49 explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.50 explain how to create or update standard operating procedures (sop's) maintenance schedules and plans.
2.51 explain the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.52 explain the limit of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 462 Carry out Maintenance Activities on Instrumentation and Control Equipment

UAN:	**H/505/0974**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 44 Carrying out maintenance activities on instrumentation and control equipment (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on instrumentation and control equipment, in accordance with approved procedures. The learner will be required to maintain a range of instrumentation and control equipment such as pressure, flow, level and temperature instruments; fiscal monitoring equipment; smoke, heat, gas, water, chemical and metal detection and alarm systems; industrial weighing systems; linear and rotational speed measurement and control; vibration monitoring equipment; photo-optic instruments; nucleonic and radiation measurement; analysers recorders and indicators; telemetry systems; emergency shutdown systems and other specific instrumentation. This will involve dismantling, removing and replacing a range of instruments and faulty peripheral components down to unit and component level, as appropriate. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and

safely.

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

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying maintenance procedures to instrumentation and control equipment and circuits. The learner will understand the maintenance methods and procedures used, and their application, and will know about the various instrumentation units and peripheral components, their functions and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and ensuring that the equipment operates to the required specification and remains compliant with all standards and regulations. The learner will also know about the interaction of the other associated integrated technologies, and will have sufficient knowledge to carry out the dismantling and reassembly of the instrumentation system safely and effectively.

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

Learning outcome
The learner will: 1. carry out maintenance activities on instrumentation and control equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where appropriate 1.3 produce and update relevant maintenance schedules and plans 1.4 review and update maintenance procedures and plans to include three the following: a. preventive maintenance (routine inspections, and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities) c. predictive maintenance (analysis of the equipment's condition) d. reactive maintenance (unexpected equipment/component failure) e. maintenance prevention (equipment/component design and development) plus supporting documentation associated with two of the following f. equipment performance g. equipment downtime/failure h. overall equipment effectiveness (OEE) i. maintenance costs j. health and safety k. staff development and training l. maintenance procedures/instructions m. operator manuals/working instructions n. regulatory compliance 1.5 lead maintenance activities within the limits of their personal authority 1.6 carry out the maintenance activities in the specified sequence and in an agreed timescale 1.7 collect fault diagnostic evidence from four of the following sources: a. the person or operator who reported the fault b. equipment self-diagnosis c. test instrument measurements (such as multimeter, oscilloscope, logic probe, signal tracer, signal generator) d. recording devices

e. plant/equipment records
f. circuit outputs/computer display (such as pressure, flow, temperature)
g. equipment outputs
h. sensory input (sight, sound, smell, touch)

1.8 use a range of fault diagnostic techniques, to include two of the following:
a. half-split technique
b. input/output technique
c. injection and sampling
d. six point technique
e. emergent sequence
f. unit substitution
g. function/performance testing
h. equipment self-diagnostics

1.9 use a variety of diagnostic aids, to include two of the following:
a. logic diagrams
b. fault analysis charts (such as fault trees)
c. flow charts or algorithms
d. manufacturers' manuals
e. probability charts/reports
f. troubleshooting guides
g. computer-aided test equipment
h. electronic aids

1.10 use all of the following fault diagnostic procedures:
a. inspection (such as breakages, wear/deterioration, signs of overheating, loose connections/fittings)
b. operation (such as manual switching off and on, automatic switching/timing/sequencing, outputs)
c. measurement (such as voltage, current, continuity, logic state, noise, frequency, signal shape, level)

1.11 use four of the following types of test equipment to aid fault diagnosis:
a. multimeter
b. pressure sources
c. oscilloscope
d. digital pressure indicators
e. signal sources/generator
f. standard test gauges
g. current injection devices
h. special purpose test equipment
i. logic probe
j. signal tracer
k. other specific test equipment

1.12 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.13 carry out all of the following during the maintenance activity:
a. obtain and use the correct issue of company and/or

manufacturer's drawings and maintenance documentation

b. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
c. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
d. provide and maintain safe access and working arrangements for the maintenance area
e. carry out the maintenance activities using appropriate techniques and procedures
f. re-connect and return the system to service on completion of activities
g. dispose of waste items in a safe and environmentally acceptable manner and leave the work area in a safe condition

1.14 carry out maintenance activities on three of the following types of instrumentation and control equipment:

a. pressure (such as absolute, gauge, vacuum)
b. flow (such as orifice plate, venturi tube, electromagnetic, ultrasonic, differential pressure cell, positive displacement)
c. level (such as floats, displacer, differential pressure cells, load cells, ultrasonic, conductivity)
d. temperature (such as bi-metallic, thermocouples, resistance, infra-red, thermal imaging)
e. weight (such as mechanical systems, load cells/strain gauges, transducers)
f. fiscal metering (such as gas, electricity, water, fuel)
g. detection and alarm (such as smoke, heat, gas, chemical, water, metal)
h. speed measurement (such as mechanical, electrical, stroboscopic)
i. emergency shutdown
j. speed control (such as mechanical governors, electrical governors, DC speed controller, AC motor control systems, stepper motors, invertors)
k. vibration monitoring (such as vibration switches, proximity probes, seismic velocity transducer, linear variable differential transformers, portable data collectors)
l. nucleonic and radiation (such as Geiger-Muller tube, neutron counter, photomultiplier tube, proportional counter)
m. analysers (such as gas detection, spectroscopy, oxygen analyser, water analysis, moisture measurement, density)
n. recorders and indicators
o. telemetry systems (such as master station, outstation, stand alone systems)
p. valves and valve mechanisms (such as control valves, valve actuators and positioners)
q. other specific instrumentation

1.15 carry out ten of the following maintenance activities, as appropriate to the equipment being maintained:

a. disconnecting electrical/pneumatic supply
b. replacing mechanical components
c. disconnecting signal transmission

d. replacing electrical components
e. disconnecting process pipework
f. replacing complete instruments
g. removing instruments from the system
h. tightening fastenings to the required torque
i. replacing peripherals (such as sensors, actuators, relays, switches)
j. replacing `lifed' items (such as seals, gaskets, batteries)
k. proof marking/labelling of removed wires or components
l. taking electrostatic discharge (ESD) precautions when handling components and circuit boards
m. setting, aligning and adjusting replaced instruments

1.16 use four of the following types of test equipment:
a. analogue or digital meters
b. oscilloscope
c. signal sources/generator
d. standard test gauges
e. current injection devices
f. pressure sources
g. logic probes
h. digital pressure indicators
i. signal tracer
j. special purpose test equipment

1.17 return instruments and systems to service, to include carrying out all of the following:
a. connecting up process impulse pipework
b. connecting up electrical/pneumatic supply
c. connecting up signal transmission (such as electrical, electronic, pneumatic, mechanical)
d. confirming that signal measurement and transmission are satisfactory
e. final re-commissioning of the system and removal of any trip defeats

1.18 maintain equipment which complies with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.20 complete relevant maintenance documentation accurately

1.21 complete the relevant maintenance documentation to include one from the following:
a. job cards
b. permit to work/formal risk assessment and/or sign-on/off procedures
c. maintenance log or report
d. company-specific recording system

1.22 dispose of waste materials in accordance with safe working practices and approved procedures 1.23 identify and lead on making improvements to maintenance processes and procedures 1.24 update management information and systems to support the activities of the maintenance department

Learning outcome
The learner will: 2. understand how to carry out maintenance activities on instrumentation and control equipment
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them 2.2 explain how to prioritise their own and their team's workload to ensure that targets are met 2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards 2.5 explain how to complete a skills audit of team members 2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified 2.7 explain the isolation and lock-off procedures or permit-to-work procedure that applies 2.8 explain the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others 2.9 explain the hazards associated with carrying out mechanical maintenance activities (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise these and reduce any risks 2.10 explain the importance of wearing protective clothing and other appropriate safety equipment during maintenance process 2.11 explain how to obtain and interpret drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process 2.12 explain the procedure to be adopted to establish the background of the fault 2.13 explain how to evaluate the various types of information available for fault diagnosis 2.14 explain how to use the various aids and reports available for fault diagnosis 2.15 explain how to use various types of fault diagnostic equipment needed to investigate the problem 2.16 explain the various fault finding techniques that can be used (such as half-split, input-to-output, emergent problem sequence, six point

technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics) and how they are applied

2.17 explain how to evaluate sensory conditions (by sight, sound, smell, touch)

2.18 explain how to analyse evidence and evaluate possible characteristics and causes of specific faults/problems

2.19 explain how to relate previous reports/records of similar fault conditions

2.20 explain how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system

2.21 explain the care, handling and application of instrumentation test instruments (such as multimeters, logic probes, oscilloscopes, signal tracers, signal generators)

2.22 explain how to check that test instruments are within current calibration dates, and that they are free from damage and defects

2.23 explain the precautions to be taken to prevent electrostatic discharge (ESD) damage to electronic circuits and components

2.24 explain the basic principles of operation of the instrumentation and control equipment being maintained, how the system functions, its operating sequence, the working purpose of individual units/components and how they interact

2.25 explain the reasons for making sure that control systems are isolated or put into manual control, and appropriate trip locks, keys or program overrides are inserted, before removing any sensors or instruments from the system

2.26 explain the identification and selection of instrument sensors (including how to identify their markings, calibration information, component values, operating parameters and working range)

2.27 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)

2.28 explain the correct and tidy installation and connection of external wiring and components, to avoid electronic interference or mechanical damage

2.29 explain how to carry out visual checks of the instruments (such as checking for leaks, security of joints and physical damage)

2.30 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process

2.31 explain company policy on the repair/replacement of components during the maintenance process

2.32 explain the techniques used to dismantle/assemble integrated equipment (such as release of pressures/force, proof marking to aid reassembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)

2.33 explain the methods of attaching identification marks/labels to removed components or cables, to assist with reassembly

2.34 explain the methods of checking that components are fit for purpose, and the need to replace electronic modules, sensors, transmitters, transducers, electronic boards and other failed items

2.35 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

2.36 explain the generation of appropriate documentation and/or

	reports following the maintenance activity
2.37	explain the equipment operating and control procedures to be applied during the maintenance activity
2.38	explain the problems that can occur during the maintenance of the instrumentation and control system, and how they can be overcome
2.39	explain the organisational procedure to be adopted for the safe disposal of waste of all types of material
2.40	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.41	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.42	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.43	explain how to create or update standard operating procedures (sop's) maintenance schedules and plans.
2.44	explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.45	explain the limit of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 463 Carry out Maintenance Activities on Mechanical Equipment within an Engineered System

UAN:	**K/505/0975**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 45 Carrying out maintenance activities on mechanical equipment within an engineered system (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on mechanical equipment within an engineered system, in accordance with approved procedures. The learner will be required to maintain a range of mechanical equipment, such as gearboxes, pumps, machine tools, conveyor systems, workholding arrangements, engines, processing plant and equipment, which are working in an integrated system involving two or more of the following interactive technologies: electrical, fluid power or process controllers. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. The learner will be expected to isolate and disconnect items and components of the interactive technologies in order to gain access to and remove the mechanical units and components that require replacing or

repair. This will involve dismantling and reassembling a variety of different types of assemblies and sub-assemblies which, in some instances, will need to be dismantled to component level.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the maintenance activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying mechanical maintenance procedures within an engineered system. The learner will know about the integrated technology assemblies and sub-assemblies, and their properties, functions and associated defects, in adequate depth to provide a sound basis for carrying out the dismantling and reassembly process safely and effectively. The learner will also understand the maintenance methods and procedures used, and their application within the engineered system, in sufficient depth to be able to carry out the maintenance activities, correct faults, and ensure that the maintained equipment functions to specification and remains compliant with all standards and regulations. The learner will also know about the interaction of the other associated integrated technologies and have sufficient knowledge to carry out the dismantling and reassembly safely and effectively.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment and taking the necessary safeguards to protect themselves

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

Learning outcome
The learner will: 1. carry out maintenance activities on mechanical equipment within an engineered system
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where appropriate 1.3 produce and update relevant maintenance schedules and plans 1.4 review and update maintenance procedures and plans to include three the following: a. preventive maintenance (routine inspections, and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities) c. predictive maintenance (analysis of the equipment's condition) d. reactive maintenance (unexpected equipment/component failure) e. maintenance prevention (equipment/component design and development) plus supporting documentation associated with two of the following f. equipment performance g. equipment downtime/failure h. overall equipment effectiveness (OEE) i. maintenance costs j. health and safety k. staff development and training l. maintenance procedures/instructions m. operator manuals/working instructions n. regulatory compliance 1.5 lead maintenance activities within the limits of their personal authority 1.6 carry out the maintenance activities in the specified sequence and in an agreed timescale 1.7 collect evidence regarding the fault from three of the following sources: a. person or operator who reported the fault

b. sensory input (such as sight, sound, smell, touch)
c. monitoring equipment or gauges
d. plant/machinery records
e. recording devices
f. condition of end product

1.8 use a range of fault diagnostic techniques, to include two of the following:
a. half-split technique
b. emergent sequence
c. unit substitution
d. input/output
e. function/performance testing
f. six point technique
g. injection and sampling
h. equipment self diagnostics

1.9 use a variety of diagnostic aids and equipment, to include two of the following:
a. manufacturer's manual
b. physical layout diagrams
c. algorithms
d. flow charts
e. probability charts/reports
f. fault analysis charts (such as fault trees)
g. equipment self diagnostics
h. trouble shooting guides

1.10 use two of the following types of test equipment to help in the fault diagnosis:
a. mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
b. electrical/electronic measuring instruments (such as multimeters, logic probes)
c. fluid power test equipment (such as test rigs, flow meters, pressure gauges)

1.11 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.12 carry out all of the following during the maintenance activity as applicable to the equipment being maintained:
a. plan and communicate the maintenance activities to cause minimal disruption to normal working
b. obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation
c. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
d. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
e. provide and maintain safe access and working arrangements for the maintenance area

f. carry out the maintenance activities using appropriate techniques and procedures
g. reconnect and return the system to service on completion of the maintenance activities
h. dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition

1.13 use appropriate dismantling and re-assembly techniques to deal with two of the following groups:

fluid power components:

a. releasing stored pressure
b. chocking/supporting cylinders/rams/components
c. disconnecting/removing hoses and pipes
d. removing and replacing units/components (such as pumps, valves, actuators)

electrical components:

e. isolating the power
f. removing/replacing minor electrical components(such as relays, sensing devices, limit switches)
g. disconnecting and reconnecting wires/cables
h. removing and replacing major electrical components (such as motors, switch/control gear)
i. removing and replacing wiring enclosures (such as conduit, trunking, traywork)

process controller components:

j. de-activating and resetting program controller
k. disconnecting/reconnecting wires/cables
l. re-loading programs and making minor amendments
m. removing and replacing program logic peripherals
n. removing and replacing input/output interfacing

1.14 carry out maintenance activities on three of the following types of mechanical equipment:

a. gearboxes
b. processing plant
c. production plant
d. mechanical structures
e. engines
f. machine tools
g. pumps
h. conveyors/elevators
i. lifting and handling equipment
j. compressors
k. process control valves
l. workholding arrangements
m. transfer equipment
n. other specific equipment

1.15 carry out all of the following maintenance techniques, as applicable to the equipment being maintained:

a. draining and removing fluids
b. tightening fastenings to the required torque
c. dismantling equipment to unit/sub-assembly level

d. making `off-load' checks before powering up
e. dismantling units to component level
f. replenishing oils and greases
g. proofmarking/labelling of components
h. functionally testing the complete system
i. setting, aligning and adjusting replaced components
j. replacing damaged/defective components
k. replacing all `lifed' items (such as seals, bearings, gaskets)
l. checking components for serviceability

1.16 replace/refit a range of mechanical components, to include seven of the following:
a. shafts
b. valves and seats
c. cams and followers
d. pulleys and belts
e. couplings
f. brakes
g. springs
h. slides
i. gears
j. bearing and seals
k. chains and sprockets
l. levers and links
m. clutches
n. fitting keys
o. locking and retaining devices (such as circlips, pins)

1.17 ensure that the maintenance activities comply with one of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.19 complete relevant maintenance documentation accurately

1.20 complete the relevant paperwork from one of the following, and pass it to the appropriate people:
a. job cards
b. permits to work/formal risk assessment and/or sign on/off procedures
c. maintenance log or report
d. company-specific recording system

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

1.22 identify and lead on making improvements to maintenance processes and procedures

1.23 identify and implement improvements in the services provided by the maintenance team to include two of the following:

a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions
f. visual management systems/documentation
g. resource planning
h. costs
i. staff development and training
j. health and safety
k. procurement
l. other (to be specified)

1.24 update management information and systems to support the activities of the maintenance department

Learning outcome
The learner will: 2. understand how to carry out maintenance activities on mechanical equipment within an engineered system
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them 2.2 explain how to prioritise their own and the team's workload to ensure that targets are met 2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards 2.5 explain how to complete a skills audit of team members 2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified 2.7 explain the isolation and lock-off procedure or permit-to-work procedure that applies to the system 2.8 explain the specific health and safety precautions to be applied during the maintenance activity, and their effects on others 2.9 explain how to recognise and deal with victims of electric shock (to include methods of safely isolating the power source and methods of first aid resuscitation) 2.10 explain the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities 2.11 explain the hazards associated with carrying out maintenance activities on an integrated system (such as handling fluids, stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risks 2.12 explain how to obtain and interpret drawings, charts,

specifications, manufacturers' manuals, history/maintenance reports and other documents needed for the maintenance activities

2.13 explain the basic principles of how the system functions, its operation sequence, the working purpose of individual units/components, and how they interact

2.14 explain 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, functional testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)

2.15 explain how to evaluate the various types of information available for fault diagnosis (such as operator reports, monitoring equipment, sensory inputs, machinery history records, and condition of the end product)

2.16 explain how to evaluate sensory information from sight, sound, smell, touch

2.17 explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions

2.18 explain how to use the various aids and reports available for fault diagnosis

2.19 explain the types 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), and how to check the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects

2.20 explain the application of specific fault finding methods and techniques that are best suited to the problem

2.21 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems

2.22 explain how to make use of previous reports/records of similar fault conditions

2.23 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 process

2.24 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance

2.25 explain the company policy on repair/replacement of components during the maintenance activities

2.26 explain the sequence to be adopted for dismantling and reassembling the equipment, to both sub-assembly and individual component level

2.27 explain the methods of removing components that have interference fits (expansion, contraction or pressure)

2.28 explain the techniques used to dismantle/assemble integrated equipment (such as release of pressures/force, proof marking to aid assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)

2.29 explain the methods of attaching identification marks/labels to removed components or cables, to assist with re-assembly

2.30 explain the methods of checking that components are fit for purpose, and the need to replace `lifed' items (such as seals, gaskets and bearings)

2.31 explain how to make adjustments to components/assemblies, to ensure they function correctly

2.32	explain how to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose
2.33	explain the importance of making `off-load' checks before proving the equipment with the electrical supply on
2.34	explain the generation of maintenance documentation and/or reports on completion of the maintenance activity
2.35	explain the equipment operating and control procedures to be applied during the maintenance activity
2.36	explain how to use lifting and handling equipment safely and correctly in the maintenance activity
2.37	explain the problems that can occur during the maintenance activity, and how they can be overcome
2.38	explain the organisational procedure to be adopted for the safe disposal of waste of all types of material
2.39	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.40	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.41	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.42	explain how to create or update standard operating procedures (sop's) maintenance schedules and plans.
2.43	explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.44	explain the extent of their authority and to whom they should report if they have a problem that they cannot resolve

Unit 464 Carry out Maintenance Activities on Electrical Equipment within an Engineered System

UAN:	**M/505/0976**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 46 Carrying out maintenance activities on electrical equipment within an engineered system (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on electrical equipment within an engineered system, in accordance with approved procedures. The learner will be required to maintain a range of electrical equipment, such as single and three-phase power supplies, motors and starters, switchgear and distribution panels, electrical plant, control systems and equipment, and luminaries, which are working in an integrated system involving two or more of the following interactive technologies: mechanical systems, fluid power or process controllers. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. The learner will be expected to isolate and disconnect items and components of the interactive technologies, in order to gain access to and remove the electrical units and

components that require replacing or repair. This will involve dismantling and reassembling a variety of different types of electrical equipment which, in some instances, will need to be dismantled to component level.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment, and materials used in the maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying electrical maintenance procedures. The learner will also know about the integrated technology assemblies and sub- assemblies, their properties, functions and associated defects, in adequate depth to provide a sound basis for carrying out the dismantling and reassembly process effectively. The learner will understand the maintenance methods and procedures used, and their application within an engineered system, in sufficient depth to be able to carry out the maintenance activities, correct faults, and ensure that the repaired equipment functions to specification and remains compliant with all standards and regulations. The learner will also know about the interaction of the other associated integrated technologies and have sufficient knowledge to carry out the dismantling and reassembly safely and effectively.

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

be required to demonstrate safe working practices throughout.

Learning outcome
The learner will: 1. carry out maintenance activities on electrical equipment within an engineered system
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where appropriate 1.3 produce and update relevant maintenance schedules and plans 1.4 review and update maintenance procedures and plans to include three the following: a. preventive maintenance (routine inspections, and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities) c. predictive maintenance (analysis of the equipment's condition) d. reactive maintenance (unexpected equipment/component failure) e. maintenance prevention (equipment/component design and development) plus supporting documentation associated with two of the following f. equipment performance g. equipment downtime/failure h. overall equipment effectiveness (OEE) i. maintenance costs j. health and safety k. staff development and training l. maintenance procedures/instructions m. operator manuals/working instructions n. regulatory compliance 1.5 lead maintenance activities within the limits of their personal authority 1.6 carry out the maintenance activities in the specified sequence and in an agreed timescale 1.7 collect evidence regarding the fault from three of the following sources: a. person or operator who reported the fault b. sensory input (such as sight, sound, smell, touch)

c. monitoring equipment or gauges
d. plant/machinery records
e. recording devices
f. condition of end product

1.8 use a range of fault diagnostic techniques, to include two of the following:
a. half-split technique
b. emergent sequence
c. unit substitution
d. input/output
e. function/performance testing
f. six point technique
g. injection and sampling
h. equipment self diagnostics

1.9 use a variety of diagnostic aids and equipment, to include two of the following:
a. manufacturer's manual
b. physical layout diagrams
c. algorithms
d. flow charts
e. probability charts/reports
f. fault analysis charts (such as fault trees)
g. equipment self diagnostics
h. trouble shooting guides

1.10 use two of the following types of test equipment to help in the fault diagnosis:
a. mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
b. electrical/electronic measuring instruments (such as multimeters, logic probes)
c. fluid power test equipment (such as test rigs, flow meters, pressure gauges)

1.11 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.12 carry out all of the following during the maintenance activity as applicable to the equipment being maintained:
a. plan and communicate the maintenance activities to cause minimal disruption to normal working
b. obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation
c. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
d. ensure the safe isolation of equipment (such as electricity, mechanical, gas, air or fluids)
e. provide and maintain safe access and working arrangements for the maintenance area
f. carry out the maintenance activities using appropriate

techniques and procedures

g. reconnect and return the system to service on completion of the maintenance activities
h. dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition

1.13 use appropriate dismantling and re-assembly techniques to deal with two of the following groups:

fluid power components:

a. releasing stored pressure
b. chocking/supporting cylinders/rams/components
c. disconnecting/removing hoses/pipes
d. removing and replacing units/components (such as pumps, valves, actuators)

mechanical components:

e. draining and replenishing fluids
f. removing major mechanical units (such as gearboxes, pumps, workholding/transfer equipment)
g. removing and refitting locking and retaining devices
h. removing minor mechanical units/sub-assemblies (such as guards, structures)
i. proofmarking components to aid reassembly
j. setting, aligning and adjusting replaced units

process controller components:

k. de-activating and resetting program controller
l. disconnecting/reconnecting wires/cables
m. reloading programs and making minor amendments
n. removing and replacing program logic peripherals
o. removing and replacing input/output interfacing

1.14 carry out maintenance activities on six of the following types of electrical equipment:

a. single-phase power supplies
b. control systems and components
c. three-phase power supplies
d. electrical plant
e. direct current power supplies
f. wiring enclosures
g. motors and starters
h. luminaires
i. switchgear and distribution panels
j. other specific electrical equipment

1.15 carry out all of the following maintenance activities, as applicable to the equipment being maintained:

a. isolating and locking off equipment
b. removing and replacing damaged wires / cables
c. disconnecting / reconnecting wires and cables
d. removing and replacing wiring enclosures
e. attaching suitable cable identification markers
f. setting and adjusting replaced components
g. removing electrical units/components
h. making `off-load' checks before powering up
i. checking components for serviceability

j. functionally testing completed system
k. replacing damaged/defective components

1.16 replace/refit a range of electrical components, to include eight of the following:
a. cables and connectors
b. switches and sensors
c. invertors and servo controllers
d. contactors
e. solenoids
f. circuit boards
g. relay components
h. capacitors
i. starters
j. lighting fixtures
k. transformers
l. rectifiers
m. batteries
n. overload protection devices
o. encoders or resolvers
p. locking and retaining devices (such as cable ties, clips, proprietary fasteners)

1.17 ensure that maintenance activities comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.19 complete relevant maintenance documentation accurately

1.20 complete the relevant paperwork from one of the following, and pass it to the appropriate people:
a. job cards
b. maintenance log or report
c. permits to work/formal risk assessment and/or sign-on/off procedures
d. company-specific documentation

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

1.22 dentify and lead on making improvements to maintenance processes and procedures

1.23 identify and implement improvements in the services provided by the maintenance team to include two of the following:
a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions

f. visual management systems/documentation
g. resource planning
h. costs
i. staff development and training
j. health and safety
k. procurement
l. other (to be specified)

1.24 update management information and systems to support the activities of the maintenance department

Learning outcome

The learner will:

2. understand how to carry out maintenance activities on electrical equipment within an engineered system

Assessment criteria

The learner can:

2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them

2.2 explain how to prioritise their own and their team's workload to ensure that targets are met

2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards

2.5 explain how to complete a skills audit of team members

2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified

2.7 explain the isolation and lock-off procedure or permit-to-work procedure that applies to the system

2.8 explain the specific health and safety precautions to be applied during the maintenance activity, and their effects on others

2.9 explain how to recognise and deal with victims of electric shock (to include methods of safely isolating the power source and methods of first aid resuscitation)

2.10 explain the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities

2.11 explain the hazards associated with carrying out electrical maintenance activities on an integrated system (such as handling fluids, stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise these and reduce any risks

2.12 explain how to obtain and interpret drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, bs7671/iet wiring regulations and other documents needed for the maintenance activities

2.13 explain the basic principles of how the system functions, its operation sequence, the working purpose of individual units/components, and how they interact

2.14 explain the procedure to be adopted to establish the background of the fault

2.15 explain how to evaluate the various types of information available for fault diagnosis

2.16 explain how to use the various aids and reports available for fault diagnosis

2.17 explain how to use various items of fault diagnostic equipment to investigate the problem

2.18 explain the various fault finding techniques that can be used, and how they are applied (such as half-split, input-to-output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)

2.19 explain how to evaluate sensory information (sight, sound, smell, touch)

2.20 explain how to analyse evidence and evaluate possible characteristics and causes of specific faults/problems

2.21 explain how to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on health and safety, and on the overall process or system

2.22 explain how to relate previous reports/records of similar fault conditions

2.23 explain the different types of cabling and their application (such as multi-core cables, single-core cables, steel wire armoured (swa), mineral insulated (mi), screened cables)

2.24 explain the different types of electric motors and motor starters

2.25 explain the different types of control systems and their various components

2.26 explain the application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)

2.27 explain the various lighting systems used including tungsten, sodium, mercury vapour, led, low energy and fluorescent

2.28 explain the different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)

2.29 explain the care, handling and application of ohmmeters, multimeters and other electrical measuring instruments

2.30 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities

2.31 explain the company policy on repair/replacement of components during the maintenance activities

2.32 explain the techniques used to dismantle/assemble integrated equipment (such as release of pressures/force, proof marking to aid re-assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)

2.33 explain the methods of removing and replacing cables and wires in wiring enclosures, without causing damage to existing cables

2.34 explain the use of bs7671/iet and other regulations when selecting wires and cables, and when carrying out tests on systems

2.35 explain the methods of attaching identification marks/labels to removed components or cables, to assist with re-assembly

2.36 explain the methods of checking that components are fit for purpose, and the need to replace `lifed' items (such as motor brushes, seals and gaskets, and overload protection devices)

2.37	explain how to make adjustments to components/assemblies to ensure they function correctly
2.38	explain how to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose
2.39	explain the importance of making `off-load' checks before proving the equipment with the electrical supply on
2.40	explain the generation of maintenance documentation and/or reports on completion of the maintenance activity
2.41	explain the equipment operating and control procedures to be applied during the maintenance activity
2.42	explain how to use lifting and handling equipment in the maintenance activity
2.43	explain the problems that can occur during the electrical maintenance activity, and how they can be overcome
2.44	explain the organisational procedure to be adopted for the safe disposal of waste of all types of materials
2.45	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.46	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.47	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.48	explain how to create or update standard operating procedures (sop's) maintenance schedules and plans
2.49	explain the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.50	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 465 Carry out Maintenance Activities on Fluid Power Equipment within an Engineered System

UAN:	**A/505/0978**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 47 Carrying out maintenance activities on fluid power equipment within an engineered system (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on fluid power equipment within an engineered system, in accordance with approved procedures. The learner will be required to maintain a range of equipment, such as pumps, valves, actuators, sensors, compressors and other fluid power equipment, which are working in an integrated system on mobile or static plant involving two or more of the following interactive technologies: mechanical, electrical, or process controller. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. The learner will be expected to isolate and disconnect items and components of the interactive technologies in order to gain access to and remove the fluid power units and components that require replacing or

repair. This will involve dismantling and reassembling a variety of different types of assemblies and sub-assemblies which, in some instances, will need to be dismantled to component level.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the maintenance activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly. The learner will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide an in depth understanding of their work, and will provide an informed approach to applying fluid power maintenance procedures. The learner will also know about the integrated technology assemblies and sub-assemblies, their properties, functions and associated defects, in adequate depth to provide a sound basis for carrying out the dismantling and reassembly process safely and effectively. The learner will understand the maintenance methods and procedures used, and their application within an engineered system, in sufficient depth to enable them to carry out the maintenance activities, correct faults, and ensure that the maintained equipment functions to specification and remains compliant with all standards and regulations. The learner will also know about the interaction of the other associated integrated technologies and have sufficient knowledge to carry out the dismantling and reassembly safely and effectively.

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

practices throughout.

Learning outcome
The learner will: 1. carry out maintenance activities on fluid power equipment within an engineered system
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines 1.2 lead a maintenance team by carrying out all the following: a. communicate the maintenance activities to the team b. involve the team in planning how the maintenance activities will be undertaken c. allocate specific maintenance activities to each team member d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures e. encourage the team and/or individuals to take the lead where appropriate 1.3 produce and update relevant maintenance schedules and plans 1.4 review and update maintenance procedures and plans to include three the following: a. preventive maintenance (routine inspections, and adjustments) b. corrective maintenance (activities identified from preventative maintenance activities) c. predictive maintenance (analysis of the equipment's condition) d. reactive maintenance (unexpected equipment/component failure) e. maintenance prevention (equipment/component design and development) plus supporting documentation associated with two of the following f. equipment performance g. equipment downtime/failure h. overall equipment effectiveness (OEE) i. maintenance costs j. health and safety k. staff development and training l. maintenance procedures/instructions m. operator manuals/working instructions n. regulatory compliance 1.5 lead maintenance activities within the limits of their personal authority 1.6 carry out the maintenance activities in the specified sequence and in an agreed timescale 1.7 collect fault diagnosis evidence from three of the following sources: a. the person or operator who reported the fault b. sensory input (such as sight, sound, smell, touch) c. test instrument/rig measurements (such as pressure, flow, sequence)

d. plant/machinery records
e. monitoring equipment or gauges
f. condition of the end product
g. recording devices

1.8 use a range of fault diagnostic techniques, to include two of the following:
a. half-split technique
b. input/output
c. emergent sequence
d. injection and sampling
e. unit substitution
f. six point technique
g. functional/performance testing
h. equipment self-diagnostics

1.9 use a variety of diagnostic aids and equipment, to include two of the following:
a. manufacturer's manual
b. physical layout diagrams
c. algorithms
d. flow charts
e. probability charts/reports
f. fault analysis charts (such as fault trees)
g. equipment self-diagnostics
h. troubleshooting guides
i. sequence charts
j. function diagrams

1.10 use all of the following diagnostic procedures:
a. inspection (for leaks, loose fittings, breakages, wear/deterioration, damage to pipes/hoses, alignment)
b. operation (such as manual operation, timing, sequencing)
c. measurement (such as pressure, flow, timing, sequence, movement)

1.11 use two of the following types of test equipment to aid fault diagnosis:
a. measuring devices/meters
b. flow indicators
c. pressure indicators
d. thermal indicators
e. test rigs
f. self-diagnostic equipment
g. contamination monitoring and analysing devices

1.12 find faults that have resulted in two of the following breakdown categories:
a. intermittent problem
b. partial failure/out-of-specification output
c. complete breakdowns

1.13 carry out all of the following during the maintenance activity:
a. plan and communicate the maintenance activities to cause minimal disruption to normal working
b. obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation

c. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
d. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
e. provide and maintain safe access and working arrangements for the maintenance area
f. carry out the maintenance activities using appropriate techniques and procedures
g. reconnect and return the system to service on completion of the maintenance activities
h. dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition

1.14 use appropriate dismantling and re-assembly techniques to deal with two of the following groups:

mechanical components:

a. draining and replenishing fluids
b. removing major mechanical units (gearboxes, pumps, workholding/transfer equipment)
c. removing and refitting locking and retaining devices
d. removing minor mechanical units/sub-assemblies(such as guards, structures)
e. proofmarking components to aid re-assembly
f. setting, aligning and adjusting replaced units

electrical components:

g. isolating power supply
h. removing / replacing minor electrical components (such as relays, sensing devices, limit switches)
i. disconnecting and reconnecting wires/cables
j. removing and replacing major electrical components (such as motors, switch/control gear)
k. removing and replacing wiring enclosures (such as conduit, trunking, traywork, cable ways)

programmable controller components:

l. de-activating and resetting program controller
m. disconnecting/re-connecting wires/cables
n. reloading programs and making minor amendments
o. removing and replacing programming devices (such as laptop, programmer, PDA)
p. removing and replacing input/output interfacing

1.15 carry out maintenance activities on two of the following types of fluid power equipment:

a. pneumatic
b. hydraulic
c. vacuum

1.16 carry out all of the following maintenance activities, as applicable to the equipment being maintained:

a. chocking/supporting actuators/rams/component
b. releasing stored pressure
c. draining, removing and replacing oil/fluids (as applicable)
d. replacing damaged/defective components

e. disconnecting/removing hoses, pipes and tubing
f. replacing all `lifed' items (such as seals, filters, gaskets, hoses)
g. proofmarking/labelling of removed components
h. checking components for serviceability
i. tightening fastenings to the required torque
j. removing and replacing units/components (such as pumps, cylinders, valves, actuators)
k. setting, aligning and adjusting replaced components
l. making `off-load' checks before re-pressurising system
m. priming and bleeding the system (where applicable)
n. functional/performance testing of the maintained system

1.17 carry out maintenance activities to component level on one of the following fluid power components:
a. pumps
b. valves
c. motors
d. actuators/cylinders

1.18 replace/refit a range of fluid power components, to include seven of the following:
a. pumps
b. bearings
c. compressors
d. sensors
e. pistons
f. reservoirs
g. receivers
h. lubricators/filters
i. spools
j. accumulators
k. gaskets and seals
l. regulators
m. valves
n. pressure intensifiers
o. pipework and hoses
p. switches
q. actuators/cylinders
r. other specific components

1.19 ensure that maintenance activities comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.21 complete relevant maintenance documentation accurately

1.22 complete the relevant paperwork from one of the following, and pass it to the appropriate people:

a. job cards
b. maintenance log or report
c. permit to work/formal risk assessment and/or sign on/off procedures
d. company-specific documentation

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

1.24 identify and lead on making improvements to maintenance processes and procedures

1.25 identify and implement improvements in the services provided by the maintenance team to include two of the following:
a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions
f. visual management systems/documentation
g. resource planning
h. costs
i. staff development and training
j. health and safety
k. procurement
l. other (to be specified)

1.26 update management information and systems to support the activities of the maintenance department

Learning outcome

The learner will:

2. understand how to carry out maintenance activities on fluid power equipment within an engineered system

Assessment criteria

The learner can:

2.1 explain the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them

2.2 explain how to prioritise their own and the team's workload to ensure that targets are met

2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards

2.5 explain how to complete a skills audit of team members

2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified

2.7 explain the isolation and lock-off procedure or permit-to-work procedure that applies to the system being worked on

2.8 explain the specific health and safety precautions to be taken during the maintenance activities, and their effects on others

2.9 explain the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities and where to obtain it

2.10 explain the hazards associated with carrying out maintenance activities on an integrated system (such as handling fluids, stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise these and reduce any risks

2.11 explain the regulations and codes of practice that apply to working with fluid power equipment

2.12 explain how to obtain and interpret drawings, charts, circuit and physical layouts, specifications, manufacturers' manuals, history/maintenance reports, symbols used in fluid power, and other documents needed for the maintenance activities

2.13 explain the basic principles of operation of the equipment to be maintained

2.14 explain 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, functional testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)

2.15 explain how to evaluate the various types of information available for fault diagnosis (such as operator reports, monitoring equipment, sensory inputs, machinery history records, and condition of the end product)

2.16 explain how to evaluate sensory information from sight, sound, smell, touch

2.17 explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions

2.18 explain how to use the various aids and reports available for fault diagnosis

2.19 explain the types 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), and how to check the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects

2.20 explain the application of specific fault finding methods and techniques that are best suited to the problem

2.21 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems

2.22 explain how to make use of previous reports/records of similar fault conditions

2.23 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 process

2.24 explain the importance of following the correct de-contamination procedures

2.25 explain the principles and theories associated with fluid power equipment (such as cascading and truth tables, logic/ladder diagrams)

2.26 explain how to construct and apply ladder logic, sequential charts/tables or functional diagrams

2.27 explain dry and lubricated systems and their application

2.28 explain the selection, types and characteristics of fluids for the system

2.29 explain the effects of pressure and flow on the performance of the system

2.30 explain the identification of different compressors (such as screw, piston, rotary, vane)

2.31 explain the identification and application of different hydraulic pumps and motors (such as piston, gear, vane)

2.32 explain the effects, and likely symptoms, of contamination in the system

2.33 explain the different types of pipework, fittings and manifolds, and their application

2.34 explain the identification, application, function and operation of different types of valves (such as poppet, spool, piston, disc and slide)

2.35 explain the identification, application function and operation of different types of sensors and actuators (such as rotary, linear, mechanical, electrical)

2.36 explain the identification, application function and operation of different types of actuators/cylinders (such as single acting, double acting, linear and telescopic)

2.37 explain the application and fitting of static and dynamic seals

2.38 explain the company policy on repair/replacement of components, and the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities

2.39 explain the sequence to be adopted for the dismantling and reassembling of the equipment, to both sub-assembly and individual component level

2.40 explain the techniques used to dismantle/re-assemble integrated equipment (release of pressures/force, proofmarking to aid assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)

2.41 explain the methods of attaching identification marks/labels to removed components or cables, to assist with re-assembly

2.42 explain the methods of checking that components are fit for purpose, and the need to replace `lifed' items (such as seals, gaskets, filters, pistons, spools and bearings)

2.43 explain how to make adjustments to components/assemblies, to ensure they function correctly

2.44 explain how to check tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose

2.45 explain the importance of making `off-load' checks before applying full pressure

2.46 explain the generation of maintenance documentation and/or reports on completion of the maintenance activity

2.47 explain the manufacturer's equipment operating and control procedures to be applied during the maintenance activity

2.48 explain how to use lifting and handling equipment in the maintenance activity

2.49 explain the problems that can occur during the maintenance activity, and how they can be overcome

2.50 explain the organisational procedure to be adopted for the safe disposal of waste of all types of materials

2.51	explain the organisational procedure to be adopted for the safe disposal of waste of all types of material
2.52	explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
2.53	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.54	explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
2.55	explain how to create or update standard operating procedures (sop's) maintenance schedules and plans.
2.56	explain the techniques required to communicate information using visual control systems (such as, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
2.57	explain the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

Unit 466 Carry out Maintenance Activities on Process Controller Equipment within an Engineered System

UAN:	**F/505/0979**
Level:	4
Credit value:	16
GLH:	56
Relationship to NOS:	This unit has been derived from national occupational standard Engineering Management Unit No: 48 Carrying out maintenance activities on process controller equipment within an engineered system (Suite 4).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead maintenance activities by carrying out corrective maintenance activities on process controller equipment within an engineered system, in accordance with approved procedures. As part of a team the learner will be required to maintain a range of process controller equipment, that typically includes process controllers or sequential controllers (such as programmable logic controllers (PLCs), Distributed Control System (DCS) or SCADA system) which are working in an integrated system involving two or more of the following interactive technologies: mechanical, electrical or fluid power. The learner will also be required to identify and implement a systematic approach to improving the equipment maintenance activities undertaken and ensure that the maintenance team have to appropriate skills, knowledge and understanding to maintain the equipment efficiently, effectively and safely. This will involve dismantling, removing and replacing faulty peripheral components,

process controller units and components, down to board level on unitary, rack or modular type process controller systems. The learner will also need to be able to up-load and download process controller programs, check them for errors, make alterations to programs and create and maintain back-up copies of completed programs.

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

The learner's underpinning knowledge will provide an in depth understanding of their work and will provide an informed approach to applying maintenance procedures on process controller systems within an integrated system. The learner will understand the maintenance methods and procedures used and their application and will know about the various process controller units and peripheral components, their functions and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and ensuring that the equipment operates to the required specification and remains compliant with all standards and regulations. The learner will also know about the interaction of the other associated integrated technologies and have sufficient knowledge to carry out the dismantling and reassembly of the process controller system safely and effectively.

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

Learning outcome

The learner will:

1. carry out maintenance activities on process controller equipment within an engineered system

Assessment criteria

The learner can:

1.1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines

1.2 lead a maintenance team by carrying out all the following:

a. communicate the maintenance activities to the team
b. involve the team in planning how the maintenance activities will be undertaken
c. allocate specific maintenance activities to each team member
d. involve the team in identifying improvements that could be made to the maintenance process and/or procedures
e. encourage the team and/or individuals to take the lead where appropriate

1.3 carry out all of the following during the maintenance activities:

a. plan and communicate the maintenance activities to cause minimal disruption to normal working
b. obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation
c. adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
d. ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
e. provide and maintain safe access and working arrangements for the maintenance area
f. carry out the maintenance activities using appropriate techniques and procedures
g. reconnect and return the system to service on completion of the maintenance activities
h. dispose of waste items in safe and environmentally acceptable manner and leave the work area in a safe condition

1.4 produce and update relevant maintenance schedules and plans

1.5 review and update maintenance procedures and plans to include three the following:

a. preventive maintenance (routine inspections and adjustments)
b. corrective maintenance (activities identified from preventative maintenance activities)
c. predictive maintenance (analysis of the equipment's condition)
d. reactive maintenance (unexpected equipment/component failure)
e. maintenance prevention (equipment/component design and development)

plus supporting documentation associated with two of the following

f. equipment performance
g. equipment downtime/failure
h. overall equipment effectiveness (OEE)

i. maintenance costs
j. health and safety
k. staff development and training
l. maintenance procedures/instructions
m. operator manuals/working instructions
n. regulatory compliance

1.6 lead maintenance activities within the limits of their personal authority

1.7 carry out the maintenance activities in the specified sequence and in an agreed timescale

1.8 carry out fault diagnosis on two of the following types of interactive technologies, to sub-assembly or component level:
a. mechanical
b. electrical
c. fluid power
d. process controller

1.9 collect information about the fault from four of the following sources:
a. the person or operator who reported the fault
b. sensory (such as sight, sound, smell, touch)
c. monitoring equipment or gauges
d. plant or machinery records/history
e. recording devices
f. condition of the end product

1.10 use a range of fault diagnostic techniques, to include two of the following:
a. half-split technique
b. emergent problem sequence
c. functional/performance testing
d. input/output
e. six point technique
f. injection and sampling
g. unit substitution
h. equipment self diagnostics

1.11 use a variety of diagnostic aids, to include two of the following:
a. manufacturer's manual
b. logic diagrams
c. algorithms
d. flow charts
e. probability charts/reports
f. fault analysis charts (such as fault trees)
g. equipment self diagnostics
h. troubleshooting guides
i. circuit diagrams/specifications

1.12 use two of the following types of test equipment to help in the fault diagnosis:
a. mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
b. electrical/electronic measuring instruments (such as multimeters, logic probes)
c. fluid power test equipment (such as test rigs, flow meters,

pressure gauges)

1.13 find faults that have resulted in two of the following breakdown categories:
   a. intermittent problem
   b. partial failure or reduced performance/out of specification product
   c. complete breakdown

1.14 use appropriate dismantling and re-assembly techniques to deal with two of the following groups:

mechanical components:
   a. draining and replenishing of fluids
   b. removing and refitting locking and retaining devices
   c. removing minor mechanical units/sub-assemblies (such as guards, structures)
   d. removing major mechanical units (such as gearboxes, pumps, mechanical handling, workholding/transfer equipment)
   e. proofmarking components to aid reassembly
   f. setting, aligning and adjusting replaced units

electrical components:
   g. isolating the power supply using correct lock-off communication procedure
   h. disconnecting and re-connecting wires/cables
   i. removing and replacing major electrical components (such as motors, switch/control gear)
   j. removing and replacing minor electrical components (such as relays, sensing devices, limit switches)
   k. removing and replacing wiring enclosures (such as conduit, trunking, cable traywork)

fluid power components:
   l. releasing stored pressure
   m. chocking/supporting cylinders/rams/components
   n. disconnecting/removing hoses/pipes
   o. removing and replacing units/components (such as pumps, valves, actuators, cylinders)

1.15 carry out maintenance activities on one of the following types of process controller equipment:
   a. unitary
   b. modular
   c. rack mount

1.16 carry out seven of the following program maintenance activities on the process controller system:
   a. select and use appropriate programming devices (such as terminals, handheld programmers and personal computers)
   b. use ladder logic, statement lists, or system flowcharts
   c. force contacts on and off
   d. edit, enter and remove contacts from lines of logic
   e. alter counter and timer settings
   f. use `on′ and `off-line′ programming use
   g. single-step mode of operation
   h. carry out on-line monitoring of programs
   i. programme by computer based authoring (to include sub-routines)

j. load, read and save programs
k. produce back-ups of completed programs

1.17 carry out all of the following during the maintenance activities:
a. take electrostatic discharge (ESD) precautions when working on or close to sensitive components and circuit boards
b. proofmark or label removed wires and components
c. inspect and/or test components for serviceability
d. use program full-run modes of operation
e. change or add circuit boards/modules
f. replace power supplies
g. replace peripherals (such as sensors, actuators, relays, switches)
h. replace process controller units
i. replace back-up batteries (as appropriate)
j. functionally test the system

1.18 ensure maintenance activities comply with three of the following:
a. organisational guidelines and procedures
b. equipment manufacturer's operating specification/range
c. British, European or International standards or directives
d. recognised compliance agency/body standards or directives
e. health, safety and environmental requirements
f. customer standards and requirements

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

1.20 complete relevant maintenance documentation accurately

1.21 complete the relevant paperwork from one of the following and pass it to the appropriate people:
a. job cards
b. maintenance log or report
c. permits to work/formal risk assessment and/or sign on/off procedures
d. company-specific documentation

1.22 dispose of waste materials and components in accordance with safe working practices and approved procedures

1.23 identify and lead on making improvements to maintenance processes and procedures

1.24 identify and implement improvements in the services provided by the maintenance team to include two of the following:
a. equipment downtime during maintenance
b. equipment performance monitoring systems
c. overall equipment effectiveness (OEE)
d. maintenance procedures
e. operator instructions
f. visual management systems/documentation
g. resource planning
h. costs
i. staff development and training
j. health and safety
k. procurement
l. other specific improvement

1.25 update management information and systems to support the activities of the maintenance department

Learning outcome
The learner will: 2. understand how to carry out maintenance activities on process controller equipment within an engineered system
Assessment criteria
The learner can: 2.1 explain the health, safety and environmental requirements of the area in which the maintenance activity is to take place and the responsibility these requirements place on them 2.2 explain how to prioritise their own and the team's workload to ensure that targets are met 2.3 explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets 2.4 explain the importance of ensuring that teams have the required skills, knowledge and understanding in order to maintain equipment to the required standards 2.5 explain how to complete a skills audit of team members 2.6 explain how maintenance teams can access the appropriate training and development programmes once a need training need has been identified 2.7 explain the isolation and lock-off procedure or permit-to-work procedure that applies to the system being worked on 2.8 explain the isolation procedure which is specific to the process controller system being worked on 2.9 explain the specific health and safety precautions that need to be applied during the maintenance activities and their effects on others 2.10 explain how to recognise and deal with victims of electric shock (to include isolating the power source and methods of first aid resuscitation) 2.11 explain the importance of wearing protective clothing (ppe) and other appropriate safety equipment during the maintenance activities and where this can be obtained 2.12 explain the procedures and precautions to be adopted to eliminate electrostatic discharge hazards 2.13 explain the hazards associated with carrying out maintenance activities on a process controlled integrated system (such as handling fluids, stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risks 2.14 explain how to obtain and interpret drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, symbols used on process controller documents and other documents needed for the maintenance activities 2.15 explain the basic principles of how the system functions, its operation sequence, the working purpose of individual units/components and how they interact 2.16 explain 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, functional testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)

2.17 explain how to evaluate the various types of information available for fault diagnosis (such as operator reports, monitoring equipment, sensory inputs, machinery history records and condition of the end product)

2.18 explain how to evaluate sensory information from sight, sound, smell, touch

2.19 explain the procedures to be followed to investigate faults and how to deal with intermittent conditions

2.20 explain how to use the various aids and reports available for fault diagnosis

2.21 explain the types 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) and how to check the equipment is calibrated or configured correctly for the intended use and that it is free from damage and defects

2.22 explain the application of specific fault finding methods and techniques that are best suited to the problem

2.23 explain how to analyse and evaluate possible characteristics and causes of specific faults/problems

2.24 explain how to make use of previous reports/records of similar fault conditions

2.25 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 process

2.26 explain the devices and systems for storing programmes

2.27 explain the procedures to be applied to storage, location and method of backing up programmes

2.28 explain the different types of interface cards and their application

2.29 explain the application of computer-based authoring software for design and development

2.30 explain the numbering system and codes used for identification of inputs and outputs

2.31 explain how to search a programme within the process controller for specific elements

2.32 explain programming techniques and codes used (such as interlocking, timers, counters, sub-routines)

2.33 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

2.34 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process

2.35 explain the company policy on repair/replacement of components during the maintenance activities

2.36 explain the techniques used to dismantle/assemble integrated equipment (such as release of pressures/force, proofmarking to aid re-assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)

2.37 explain the methods of attaching identification marks/labels to removed components or cables to assist with re-assembly

2.38	explain the methods of checking that components are fit for purpose and the need to replace items such as batteries, boards and other failed items
2.39	explain how to check that tools and equipment are free from damage or defects, are in a safe and usable condition and are configured correctly for the intended purpose
2.40	explain the importance of making `off-load' checks before proving the equipment with the electrical supply on
2.41	explain the generation of maintenance documentation and/or reports on completion of the maintenance activity
2.42	explain the equipment operating and control procedures to be applied during the maintenance activity
2.43	explain how to use lifting and handling equipment in the maintenance activity
2.44	explain the problems that can occur during the maintenance of the process controller system and how they can be overcome
2.45	explain the organisational procedure to be adopted for the safe disposal of waste of all types of materials
2.46	explain the extent of their own authority and to whom they should report if they have a problem they cannot resolve

Unit 467 Build, support and manage a team

UAN:	**F/600/9682**
Level:	4
Credit value:	4
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D9.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre
Aim:	This unit is about building a team and managing it through its various stages of growth. Learners will be able to support team development, effectively communicate roles and responsibilities within a team, manage team performance and understand how to disband a team.

Learning outcome
The learner will: 1. understand the purpose and required attributes of a team and select those that match the team's requirements
Assessment criteria
The learner can: 1.1 explain the role of a team in the achievement of a specific project or activity 1.2 identify the attributes needed within the team to achieve its objectives 1.3 analyse the skills and knowledge of potential and current team members against the identified needs 1.4 identify individuals whose attributes most closely match the identified requirements.

Learning outcome
The learner will: 2. be able to induct team members and communicate their roles and responsibilities
Assessment criteria
The learner can: 2.1 communicate project aims and objectives to team members 2.2 explain how to introduce team members to each other and discuss each member's role and responsibilities.

Learning outcome
The learner will: 3. understand how to support team development
Assessment criteria
The learner can: 3.1 identify the stages of team development 3.2 explain how to resolve conflict between team members 3.3 describe methods of encouraging team members to share knowledge and skills to achieve project objectives 3.4 explain how to encourage open communication, trust and respect between team members.

Learning outcome
The learner will: 4. be able to manage team performance and understand how to disband a team
Assessment criteria
The learner can: 4.1 monitor and review the performance of a team against its purpose 4.2 communicate project developments and to team members and support any change in roles or responsibilities 4.3 communicate team and individual successes to the all team members.

Learning outcome
The learner will: 5. understand how to disband team
Assessment criteria
The learner can: 5.1 explain how to prepare team members for project conclusion 5.2 describe how team is disbanded.

Unit 468 Develop, maintain and review personal networks

UAN:	**R/600/9587**
Level:	4
Credit value:	4
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC A3.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit is about developing personal networks to support current and future work. Learners will understand benefits of networking and the need for confidentiality within personal networks. Learners will also have the opportunity to develop their own personal network of contacts and evaluate their own networking relationships.

Learning outcome
The learner will: 1. understand the benefits of networking and the need for data privacy
Assessment criteria
The learner can: 1.1 evaluate the benefits of networking with individuals and organisations 1.2 identify individuals and organisations that would provide benefits to own organisation and networks 1.3 explain the need for confidentiality with networking contacts

Learning outcome
The learner will: 2. be able to develop a personal network of contacts
Assessment criteria
The learner can: 2.1 develop networks that will provide personal and organisational benefit 2.2 develop guidelines for working with networks in line with organisational procedures

Learning outcome
The learner will: 3. be able to review networking relationships
Assessment criteria
The learner can: 3.1 assess the value own current personal network 3.2 evaluate own experience with existing contacts and use these to inform future actions.

Unit 469 Review risk management processes in own area of responsibility

UAN:	**L/600/9622**
Level:	4
Credit value:	3
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC B10c.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to review risk management processes in their area of responsibility.

Learning outcome
The learner will: 1. be able to monitor and evaluate risk management processes within own area of responsibility
Assessment criteria
The learner can: 1.1 identify information from own area of responsibility to review the risk management process 1.2 assess the effectiveness of the risk management process.

Learning outcome
The learner will: 2. be able to improve the risk management process
Assessment criteria
The learner can: 2.1 implement changes to the risk management process where potential improvements have been identified.

Unit 470 Provide leadership and direction for own area of responsibility

UAN:	**T/600/9601**
Level:	4
Credit value:	5
GLH:	30
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC B6.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to provide leadership and direction for their area of responsibility.

Learning outcome
The learner will: 1. be able to lead in own area of responsibility
Assessment criteria
The learner can: 1.1 identify own strengths and ability to lead in a leadership role 1.2 evaluate strengths within own area of responsibility.

Learning outcome
The learner will: 2. be able to provide direction and set objectives in own area of responsibility
Assessment criteria
The learner can: 2.1 outline direction for own area of responsibility 2.2 implement objectives with colleagues that align with those of the organization.

Learning outcome
The learner will: 3. be able to communicate the direction for own area of responsibility and collect feedback to inform improvement
Assessment criteria
The learner can: 3.1 communicate the agreed direction to individuals within own area of responsibility 3.2 collect feedback to inform improvement.

Learning outcome
The learner will: 4. be able to assess own leadership performance
Assessment criteria
The learner can: 4.1 assess feedback on own leadership performance 4.2 evaluate own leadership performance.

Unit 471 Ensure compliance with legal, regulatory, ethical and social requirements

UAN:	**H/600/9609**
Level:	4
Credit value:	5
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC B8.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to monitor the operational compliance of procedures in meeting legal, regulatory, ethical and social requirements. Learners will also be able to identify and make recommendations on areas of non-compliance with procedures in their area of responsibility.

Learning outcome
The learner will: 1. be able to monitor the operational compliance of procedures in meeting legal, regulatory, ethical and social requirements
Assessment criteria
The learner can: 1.1 monitor the operational compliance of procedures in meeting legal, regulatory, ethical and social requirements.

Learning outcome
The learner will: 2. be able to identify and make recommendations on areas of non-compliance with procedures for legal, regulatory, ethical and social requirements relating to own area of responsibility
Assessment criteria
The learner can: 2.1 identify areas of non-compliance with legal, regulatory, ethical and social procedures 2.2 examine reasons for non-compliance with procedures 2.3 make recommendations for corrections to ensure compliance with procedures.

Unit 472 Implement change in own area of responsibility

UAN:	**M/600/9659**
Level:	4
Credit value:	6
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC C6.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to implement and monitor change within their area of responsibility.

Learning outcome
The learner will: 1. understand how to implement change in own area of responsibility
Assessment criteria
The learner can: 1.1 explain the main models and methods for managing change.

Learning outcome
The learner will: 2. be able to involve and support others through the change process
Assessment criteria
The learner can: 2.1 communicate the benefits of and reasons for change and how they relate to business objectives 2.2 implement and agree a plan to support change.

Learning outcome
The learner will: 3. be able to implement and monitor a plan for change in own area of responsibility
Assessment criteria
The learner can: 3.1 apply smart (specific, measurable, achievable, realistic and time-bound) objectives with individuals and teams to plan for change 3.2 assess opportunities and barriers to change 3.3 review action plans and activities according to identified opportunities and barriers to change.

Unit 473 Support individuals to develop and take responsibility for their performance

UAN:	**D/600/9690**
Level:	4
Credit value:	4
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D13.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to support individuals to develop and maintain their performance at work.

Learning outcome
The learner will: 1. be able to agree their performance development needs with an individual
Assessment criteria
The learner can: 1.1 explain the standards of performance required for current or future role with an individual 1.2 identify and agree the performance development needs for the individual.

Learning outcome
The learner will: 2. be able to understand how to help an individual create a development plan
Assessment criteria
The learner can: 2.1 identify options available to support an individual in meeting desired standards of performance 2.2 explain specific actions needed to achieve objectives 2.3 explain the process for an individual to create a development plan.

Learning outcome
The learner will: 3. be able to support an individual in implementing their development plan
Assessment criteria
The learner can: 3.1 describe the opportunities provided for an individual to improve performance 3.2 explain the outcome to an individual for improved performance.

Learning outcome
The learner will: 4. be able to evaluate an individual's progress against a development plan and provide feedback for continual performance improvement
Assessment criteria
The learner can: 4.1 monitor and evaluate an individual's progress against their development plan 4.2 implement feedback to make development plan revisions 4.3 explain how to encourage individuals to take responsibility for continuing their performance development.

Unit 474 Know how to follow disciplinary procedures

UAN:	**H/600/9691**
Level:	4
Credit value:	4
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D14.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to initiate and follow organisation's disciplinary procedure in response to misconduct or unsatisfactory performance of a member in their team.

Learning outcome
The learner will: 1. be able to understand performance expectations of an organisation
Assessment criteria
The learner can: 1.1 explain an organisation's required standards of conduct and performance 1.2 explain an organisation's formal disciplinary procedure.

Learning outcome
The learner will: 2. be able to identify and use communication methods to assess potential cases of misconduct or unsatisfactory performance
Assessment criteria
The learner can: 2.1 explain how to identify when an individual's performance falls below organisational standards 2.2 identify communication methods used to gather information on potential cases of misconduct or unsatisfactory performance.

Learning outcome
The learner will: 3. be able to know how to informally with cases of minor misconduct or unsatisfactory performance
Assessment criteria
The learner can: 3.1 identify the differences between misconduct, gross misconduct and unsatisfactory performance, and how each should be handled 3.2 evaluate whether a case of misconduct or unsatisfactory performance can be dealt with informally 3.3 assess methods available to improve performance or behaviour 3.4 explain the importance of recording informal disciplinary proceedings.

Learning outcome
The learner will: 4. be able to follow an organisation's formal disciplinary procedure
Assessment criteria
The learner can: 4.1 explain the importance of seeking advice and guidance from specialists prior to taking action 4.2 explain when to follow formal disciplinary procedures 4.3 assess the importance of communicating disciplinary procedures to individuals 4.4 explain how to record and store information throughout the disciplinary process.

Unit 475 Managing grievance procedures

UAN:	**K/600/9692**
Level:	4
Credit value:	3
GLH:	10
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D15.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to initiate and follow the organisation's grievance procedure in response to a concern, problem or complaint raised by team members.

Learning outcome
The learner will: 1. understand how to prevent potential grievances
Assessment criteria
The learner can: 1.1 identify situations that are likely to lead to grievances in an organisation 1.2 explain how to prevent potential grievances.

Learning outcome
The learner will: 2. understand an organisation's grievance policy and procedure and deal with concerns raised by individuals informally
Assessment criteria
The learner can: 2.1 explain an organisation's grievance policy and procedure 2.2 identify the circumstances where a concern may be dealt with informally 2.3 explain the methods used to deal informally with concerns.

Learning outcome
The learner will: 3. understand how to follow grievance procedures
Assessment criteria
The learner can: 3.1 explain how to follow an organisation's written grievance procedure 3.2 explain the importance of communicating grievance procedures 3.3 identify how to seek advice and guidance from specialists or colleagues when dealing with grievances 3.4 explain how to record and store information throughout the grievance process.

Unit 476 Support the management of redundancies in own area of responsibility

UAN:	**M/600/9693**
Level:	4
Credit value:	3
GLH:	15
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D16.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to manage situations when they are required to dismiss individuals who report to them for reasons of redundancy.

Learning outcome
The learner will: 1. understand how to follow redundancy policy within own area of responsibility
Assessment criteria
The learner can: 1.1 explain own organisation's redundancy policy, processes and any appeals procedures 1.2 identify how to access support from colleagues or specialists when following redundancy processes.

Learning outcome
The learner will: 2. communicate information on redundancies to those affected
Assessment criteria
The learner can: 2.1 explain how continuous communication with those affected by the redundancy policy 2.2 explain the form of communication required to inform individuals selected for redundancy 2.3 assess how to maintain the morale of remaining individuals.

Learning outcome
The learner will: 3. understand how to support those affected by redundancies
Assessment criteria
The learner can: 3.1 identify where support from colleagues or specialists may be accessed by those affected by redundancies.

Unit 477 Develop working relationships with colleagues and stakeholders

UAN:	**K/600/9661**
Level:	4
Credit value:	4
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D2
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to develop productive working relationships with internal and external colleagues and with identified stakeholders.

Learning outcome
The learner will: 1. know how to identify stakeholders and their relevance to an organisation
Assessment criteria
The learner can: 1.1 identify an organisation's stakeholders 1.2 evaluate the roles, responsibilities, interests and concerns of stakeholders 1.3 assess the importance of identified stakeholders.

Learning outcome
The learner will: 2. understand how to establish working relationships with colleagues and stakeholders
Assessment criteria
The learner can: 2.1 clarify how to agree a common sense of purpose with colleagues and stakeholders 2.2 summarise how to create an environment of trust and mutual respect with colleagues and stakeholders.

Learning outcome
The learner will: 3. be able to create an environment of trust and mutual respect with colleagues and stakeholders
Assessment criteria
The learner can: 3.1 review and revise the needs and motivations of colleagues and stakeholders 3.2 demonstrate interaction with colleagues and stakeholders that allows respect for the views and actions of others.

Unit 478 Support learning and development within own area of responsibility

UAN:	**M/600/9676**
Level:	4
Credit value:	5
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D7
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre
Aim:	This unit helps learners to understand the importance of learning and to develop a learning environment within their area of responsibility.

Learning outcome
The learner will: 1. be able to identify the learning needs of colleagues in own area of responsibility
Assessment criteria
The learner can: 1.1 identify gaps between requirements of colleagues' current or future work roles and their existing knowledge, understanding and skills 1.2 prioritise learning needs of colleagues 1.3 produce personal development plans for colleagues in own area of responsibility.

Learning outcome
The learner will: 2. understand how to develop a learning environment in own area of responsibility
Assessment criteria
The learner can: 2.1 explain the benefits of continual learning and development 2.2 explain how learning opportunities can be provided for own area of responsibility.

Learning outcome
The learner will: 3. be able to support colleagues in learning and its application
Assessment criteria
The learner can: 3.1 identify information, advice and guidance to support learning 3.2 communicate to colleagues to take responsibility for their own learning 3.3 explain to colleagues how to gain access to learning resources 3.4 support colleagues to practise and reflect on what they have learned.

Learning outcome
The learner will: 4. be able to evaluate learning outcomes and future learning and development of colleagues
Assessment criteria
The learner can: 4.1 examine with each colleague, whether the learning activities undertaken have achieved the desired outcomes 4.2 support colleagues when updating their personal development plan.

Unit 479 Address performance problems affecting team members

UAN:	**F/600/9679**
Level:	4
Credit value:	3
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC D8
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre
Aim:	This unit allows learners to help members of their team address problems affecting their performance. These may be work-related problems or problems arising from personal circumstances.

Learning outcome
The learner will: 1. understand legal requirements, industry regulations, organisational policies and professional codes concerning performance
Assessment criteria
The learner can: 1.1 identify legal requirements, industry regulations, organisational policies and professional codes concerning performance 1.2 explain limits of own authority relating to performance problems.

Learning outcome
The learner will: 2. be able to identify performance problems of team members
Assessment criteria
The learner can: 2.1 assess team member's performance against performance criteria 2.2 evaluate causes of identified performance problems.

Learning outcome
The learner will: 3. be able to discuss performance problems with team members
Assessment criteria
The learner can: 3.1 identify performance problems to the attention of the team member concerned 3.2 explain an organisation's policies for managing performance problems to the team member concerned 3.3 develop a confidential record of discussions with team members about problems affecting their performance.

Learning outcome
The learner will: 4. be able to set a course of action to deal with identified problems with team members
Assessment criteria
The learner can: 4.1 explain and discuss alternative courses of action with the team member concerned 4.2 identify the course of action with the team member concerned 4.3 review and revise confidential records of discussions with team members about problems affecting their performance.

Unit 480 Manage a tendering process

UAN:	**H/600/9738**
Level:	4
Credit value:	4
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC E16
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to manage tendering processes against a specification.

Learning outcome
The learner will: 1. understand tendering processes
Assessment criteria
The learner can: 1.1 explain the legal requirements of a tendering process 1.2 explain organisational tendering policies and processes 1.3 explain how to seek specialist support for the tendering process.

Learning outcome
The learner will: 2. be able to draw up a specification for required products or services
Assessment criteria
The learner can: 2.1 consult with colleagues to identify and agree requirements for products or services 2.2 draw up a specification that describes the products or services required.

Learning outcome
The learner will: 3. be able to write an invitation to tender document and communicate it to prospective suppliers
Assessment criteria
The learner can: 3.1 write an invitation to tender outlining required specifications and organisational tendering processes 3.2 communicate the invitation to tender to prospective suppliers.

Learning outcome
The learner will: 4. understand how to respond fairly to pre-tender queries
Assessment criteria
The learner can: 4.1 explain how to respond to pre-tender queries in ways that ensure all prospective suppliers have the same information.

Learning outcome
The learner will: 5. be able to evaluate received tenders
Assessment criteria
The learner can: 5.1 establish criteria with which to evaluate received tenders 5.2 receive, record and open tenders in line with stated tendering process 5.3 seek clarification from prospective suppliers where necessary 5.4 evaluate tenders against established criteria.

Learning outcome
The learner will: 6. be able to select a supplier and provide post-tender feedback
Assessment criteria
The learner can: 6.1 offer a contract to the chosen supplier 6.2 inform unsuccessful suppliers of the outcome and provide feedback.

Unit 481 Develop and implement a risk assessment plan in own area of responsibilty

UAN:	**L/600/9703**
Level:	4
Credit value:	6
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC E6
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to develop and implement a risk assessment plan in their area of responsibility.

Learning outcome
The learner will: 1. understand the legal requirements and personal responsibilities for health and safety within an organisation
Assessment criteria
The learner can: 1.1 state the legal requirements that apply to own role in relation to health and safety 1.2 consult with specialist advisor(s) on health and safety policy and procedures 1.3 explain an organisation's health and safety responsibilities 1.4 describe health and safety responsibilities in own area of responsibility.

Learning outcome
The learner will: 2. be able to promote the importance of health and safety practices
Assessment criteria
The learner can: 2.1 communicate an organisation's written health and safety policy to individuals within own area of responsibility 2.2 allocate sufficient resources to deal with health and safety issues in own area of responsibility.

Learning outcome
The learner will: 3. be able to ensure that hazards and risks are identified and managed in own area of responsibility
Assessment criteria
The learner can: 3.1 consult with colleagues on health and safety hazards and risks in own area of responsibility 3.2 assess health and safety hazards and risks in own area of responsibility 3.3 identify hazards and risks that require action to be taken to ensure compliance with legal and organisational requirements 3.4 develop and implement a plan in own area of responsibility.

Learning outcome
The learner will: 4. be able to monitor and review health and safety performance and policy in own area of responsibility
Assessment criteria
The learner can: 4.1 establish procedures that monitor health and safety performance in own area of responsibility 4.2 review the health and safety performance of own area of responsibility 4.3 review the health and safety policy in own area of responsibility.

Unit 482 Manage physical resources

UAN:	**K/600/9711**
Level:	4
Credit value:	3
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC E8.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to identify, obtain, manage and review the use of physical resources. The unit also ensures learners are able to take the environmental impact of resource use into consideration.

Learning outcome
The learner will: 1. understand the importance of sustainability when using physical resources
Assessment criteria
The learner can: 1.1 explain the importance of using sustainable resources 1.2 explain the potential impact of resource use on the environment 1.3 explain how to use resources effectively and efficiently 1.4 describe actions one can take to minimise any adverse environmental impact of using physical resources.

Learning outcome
The learner will: 2. be able to identify resource requirements for own area of responsibility
Assessment criteria
The learner can: 2.1 consult with colleagues to identify their planned activities and corresponding resource needs 2.2 evaluate past resource use to inform expected future demand 2.3 identify resource requirements for own area of responsibility.

Learning outcome
The learner will: 3. be able to obtain required resources for own area of responsibility
Assessment criteria
The learner can: 3.1 submit a business case to procure required resources 3.2 review and agree required resources with relevant individuals 3.3 explain an organisation's processes for procuring agreed resources.

Learning outcome
The learner will: 4. be able to monitor and review the quality and usage of resources in own area of responsibility
Assessment criteria
The learner can: 4.1 monitor the quality of resources against required specifications 4.2 identify differences between actual and planned use of resources and take corrective action 4.3 analyse the effectiveness and efficiency of resource use in own area of responsibility 4.4 make recommendations to improve the effectiveness and efficiency of resource use.

Unit 483 Manage the environmental impact of work activities

UAN:	**M/600/9712**
Level:	4
Credit value:	5
GLH:	10
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC E9.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to understand how to assess the environmental impact of their work. Learners will also be able to operate in such a way as to reduce their impact on the environment.

Learning outcome
The learner will: 1. understand the legal requirements and environmental policies that impact on own area of responsibility
Assessment criteria
The learner can: 1.1 explain the legal requirements that impact on own area of responsibility 1.2 explain the environmental policies that impact on own area of responsibility.

Learning outcome
The learner will: 2. understand how to assess the impact of work activities on the environment and how this can be minimised
Assessment criteria
The learner can: 2.1 explain what specialist advice is available to manage the environmental impact of work activities 2.2 explain how to assess the impact of work activities and resources on the environment 2.3 explain how to minimise the environmental impact of work activities.

Learning outcome
The learner will: 3. be able to assess and report on the environmental impact of work activities in own area of responsibility
Assessment criteria
The learner can: 3.1 assess the environmental impact of work activities and resource use 3.2 produce a report on the environmental impact of work activities and resource use, with recommendations for improvement.

Learning outcome
The learner will: 4. be able to organise work activities and resource use to minimise environmental impact
Assessment criteria
The learner can: 4.1 adapt the use of resources in own area of responsibility to reduce environmental impact 4.2 organise activities in own area of responsibility to reduce environmental impact.

Learning outcome
The learner will: 5. be able to promote ongoing improvement in environmental performance
Assessment criteria
The learner can: 5.1 establish means by which individuals can identify and report opportunities for improving environmental performance 5.2 communicate environmental benefits resulting from changes to work activities.

Unit 484 Prepare for and support quality audits

UAN:	**Y/600/9798**
Level:	4
Credit value:	4
GLH:	20
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC F14.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to prepare for, and participate in, quality audits within their area of responsibility as part of a formal quality management system.

Learning outcome
The learner will: 1. understand the quality standards and procedures that apply to own area of responsibility
Assessment criteria
The learner can: 1.1 describe the quality standards and procedures that apply to own area of responsibility.

Learning outcome
The learner will: 2. be able to monitor work in own area of responsibility against quality standards and procedures
Assessment criteria
The learner can: 2.1 select and apply methods for monitoring work.

Learning outcome
The learner will: 3. be able to prepare for a quality audit in own area of responsibility
Assessment criteria
The learner can: 3.1 prepare and organise records and documentation for the quality auditor 3.2 review previous quality audits and ensure agreed

recommendations have been implemented.

Learning outcome
The learner will: 4. be able to discuss quality audit findings with the auditor
Assessment criteria
The learner can: 4.1 discuss with the auditor the results of the audit and identify any areas for improvement 4.2 agree corrective actions to remedy any identified issues, and set a date for their implementation.

Learning outcome
The learner will: 5. be able to complete agreed actions following a quality audit
Assessment criteria
The learner can: 5.1 take corrective action based on quality audit findings.

Unit 485 Develop and implement marketing plans

UAN:	**K/600/9790**
Level:	4
Credit value:	6
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC F4.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to develop and implement marketing plans for their area of responsibility.

Learning outcome
The learner will: 1. be able to identify and prioritise marketing objectives for own area of responsibility
Assessment criteria
The learner can: 1.1 analyse the organisation's business plan to identify marketing objectives for own area of responsibility 1.2 explain the organisation's culture, vision and values 1.3 analyse and prioritise marketing objectives.

Learning outcome
The learner will: 2. be able to produce a marketing strategy in own area of responsibility
Assessment criteria
The learner can: 2.1 describe and evaluate the target markets for own organisation's products or services 2.2 identify and consult with marketing specialists if required 2.3 identify marketing tools and models to develop a strategy 2.4 develop a marketing strategy based on key success criteria for own area of responsibility.

Learning outcome
The learner will: 3. be able to produce and implement a marketing plan for own area of responsibility
Assessment criteria
The learner can: 3.1 evaluate the resource requirements for the marketing plan 3.2 produce a marketing plan based on the strategy 3.3 agree roles and responsibilities of stakeholders 3.4 communicate the marketing plan with key stakeholders.

Learning outcome
The learner will: 4. monitor and evaluate the marketing plan in own area of responsibility
Assessment criteria
The learner can: 4.1 monitor progress of the marketing plan against business objectives 4.2 assess and evaluate the impact of the marketing plan 4.3 revise future marketing plans based on the impact evaluation.

Unit 486 Analyse the market in which your organisation operates

UAN:	**M/600/9791**
Level:	4
Credit value:	5
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC F9.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to analyse customer and market needs using research tools and techniques in order to inform managerial decisions.

Learning outcome
The learner will: 1. be able to analyse customers' needs
Assessment criteria
The learner can: 1.1 assess the economic environment in which your organisation operates 1.2 evaluate your customers' needs and relate to own organisation 1.3 analyse customer perception of own products/ services in comparison to competitors.

Learning outcome
The learner will: 2. be able to analyse the market using research tools and techniques
Assessment criteria
The learner can: 2.1 identify and utilise market research specialists if necessary 2.2 analyse current and future macro and micro economic trends in own sector 2.3 use recognised research tools to assess market trends and opportunities for growth.

Learning outcome
The learner will: 3. be able to communicate research findings to inform managerial decisions
Assessment criteria
The learner can: 3.1 produce a report based on research findings 3.2 communicate the report to key individuals within own organisation. 3.3 evaluate feedback from key individuals 3.4 revise and communicate updated report to key individuals 3.5 monitor the economic environment and changes in customers' needs.

Unit 487 Develop and evaluate operational plans for own area of responsibility

UAN:	**Y/600/9588**
Level:	5
Credit value:	6
GLH:	25
Relationship to NOS:	This unit directly relates to the Management and Leadership NOS MSC B1.
Endorsement by a sector or regulatory body:	This unit has been developed by the Management Standards Centre.
Aim:	This unit allows learners to develop and evaluate operational plans for their area of responsibility.

Learning outcome
The learner will: 1. be able to align objectives of own area of responsibility with those of own organisation
Assessment criteria
The learner can: 1.1 identify operational objectives within own area of responsibility 1.2 analyse objectives of own area of responsibility in relation to those of own organization.

Learning outcome
The learner will: 2. be able to implement operational plans in own area of responsibility
Assessment criteria
The learner can: 2.1 assess risks associated with operational plans and include contingency arrangements 2.2 identify support from relevant stakeholders 2.3 implement operational plan within own area of responsibility.

Learning outcome
The learner will: 3. be able to monitor and evaluate operational plans in own area of responsibility
Assessment criteria
The learner can: 3.1 monitor procedures within the operational plan 3.2 evaluate operational plans and implement any necessary actions.

Unit 488 Manage the achievement of customer satisfaction

UAN:	**A/600/9793**
Level:	4
Credit value:	5
GLH:	25
Relationship to NOS:	This unit is linked to MSC F11 Manage the achievement of customer satisfaction
Endorsement by a sector or regulatory body:	Learning outcomes 1, 2 and 4 must be assessed using methods appropriate to the assessment of knowledge and understanding. Learning outcomes 3 and 5 in this unit require performance evidence of the learner working in a genuine organisational context. The assessment of Learning outcomes 3 and 5 must include: • Examining products of work Supplementary evidence may be gathered by: • Observation of performance in a work environment • Questioning • Discussion • Use of others (witness testimony) • Looking at practitioner statements
Aim:	This unit helps learners to understand the importance of monitoring customer service satisfaction levels to manage the achievement of customer satisfaction.

Learning outcome
The learner will: 1. be able to understand customer service standards required in own organisation
Assessment criteria
The learner can: 1.1 explain customer service standards within own organisation 1.2 describe customer service best practice in own sector using research techniques.

Learning outcome
The learner will: 2. be able to implement sustainable processes for customer satisfaction
Assessment criteria
The learner can: 2.1 define sustainable processes taking into account environmental issues 2.2 identify sustainable processes to support customer service standards 2.3 produce a plan for implementation 2.4 state customer service standards with relevant key stakeholders 2.5 ensure resources are provided to deliver agreed standards of customer service.

Learning outcome
The learner will: 3. be able to manage and support colleagues in delivering customer service standards
Assessment criteria
The learner can: 3.1 communicate customer service roles and responsibilities with employees in own organization.

Learning outcome
The learner will: 4. be able to manage and develop culture in own organisation to support customer service standards
Assessment criteria
The learner can: 4.1 evaluate the culture in own organisation 4.2 identify techniques for improving motivation amongst employees 4.3 describe motivational strategies for improving customer service standards.

Learning outcome
The learner will: 5. be able to monitor customer service levels for continuous improvement
Assessment criteria
The learner can: 5.1 describe methods of measuring customer satisfaction 5.2 develop processes for monitoring customer satisfaction, including customer feedback mechanisms 5.3 review employee performance to ensure customer service standards and organisational values are met 5.4 analyse and monitor customer service.

Unit 489 Plan, allocate and monitor work in own area of responsibility

UAN:	**H/600/9674**
Level:	4
Credit value:	5
GLH:	25
Relationship to NOS:	This unit is linked to MSC D6 Allocate and monitor the progress and quality of work in your area of responsibility
Endorsement by a sector or regulatory body:	This is a competence-based unit which requires performance evidence of the learner working with in a genuine organisational context. The assessment of this unit must include: • Examining products of work Supplementary evidence may be gathered by: • Questioning • Discussion • Use of others (witness testimony) • Looking at practitioner statements
Aim:	This unit helps learners to plan, allocate and monitor work in own area of responsibility, and make any necessary changes to original work plans.

Learning outcome
The learner will: 1. be able to produce a work plan for own area of responsibility
Assessment criteria
The learner can: 1.1 explain the context in which work is to be undertaken 1.2 identify the skills base and the resources available 1.3 examine priorities and success criteria needed for the team 1.4 produce a work plan for own area of responsibility.

Learning outcome
The learner will: 2. be able to allocate and agree responsibilities with team members
Assessment criteria
The learner can: 2.1 identify team members' responsibilities for identified work activities 2.2 agree responsibilities and smart (specific, measurable, achievable, realistic and time-bound) objectives with team members.

Learning outcome
The learner will: 3. be able to monitor the progress and quality of work in own area of responsibility and provide feedback
Assessment criteria
The learner can: 3.1 identify ways to monitor progress and quality of work 3.2 monitor and evaluate progress against agreed standards and provide feedback to team members.

Learning outcome
The learner will: 4. be able to review and amend plans of work for own area of responsibility and communicate changes
Assessment criteria
The learner can: 4.1 review and amend work plan where changes are needed 4.2 communicate changes to team members.

Unit 490 Manage budgets

UAN:	**T/601/2580**
Level:	4
Credit value:	5
GLH:	29
Relationship to NOS:	This unit directly relates to the Business and Administration NOS BAA533.
Endorsement by a sector or regulatory body:	This unit has been developed by the Council for Administration
Aim:	This unit is about managing and monitoring a budget for a department or section within an organisation.

Learning outcome
The learner will: 1. understand the purpose of budgets
Assessment criteria
The learner can: 1.1 explain the purpose and benefits of managing financial resources effectively and efficiently 1.2 identify legal, regulatory and organisational requirements for managing a budget 1.3 describe different types of budgetary systems and their features.

Learning outcome
The learner will: 2. understand how to manage budgets
Assessment criteria
The learner can: 2.1 describe methods for monitoring, controlling and recording income and expenditure 2.2 describe ways in which costs may be minimised in own area of responsibility 2.3 identify situations in which corrective action may be needed 2.4 describe the scope of own authority for managing a budget and authorising expenditure.

Learning outcome
The learner will: 3. understand how to report performance against budgets
Assessment criteria
The learner can: 3.1 explain the purpose and benefits of reporting information on performance against budget 3.2 explain how to check the accuracy of budget calculations 3.3 explain the purpose and benefits of recording information that will help with the future preparation of budgets.

Learning outcome
The learner will: 4. be able to manage budgets
Assessment criteria
The learner can: 4.1 control budget performance within limits and deadlines 4.2 analyse and take action to minimise costs where possible 4.3 take corrective action to make sure of best value for money 4.4 authorise expenditure within the scope of own authority.

Learning outcome
The learner will: 5. be able to monitor budgets
Assessment criteria
The learner can: 5.1 record transactions, as required 5.2 produce information on performance against budget, when required 5.3 make sure all calculations are accurate 5.4 record information that will help with the preparation of future budgets.

Unit 491 Agree a budget

UAN:	**J/601/2552**
Level:	3
Credit value:	4
GLH:	25
Relationship to NOS:	This unit directly relates to the Business and Administration NOS BAA531.
Endorsement by a sector or regulatory body:	This unit has been developed by the Council for Administration
Aim:	This unit is about developing and agreeing a budget for a department or section within a business.

Learning outcome
The learner will: 1. understand how to develop budgets
Assessment criteria
The learner can: 1.1 explain how to use estimations when developing a draft budget 1.2 explain how to identify priorities and financial resources needed when preparing a budget 1.3 explain the purpose and benefits of identifying priorities when preparing a budget 1.4 explain the purpose and benefits of evaluating and justifying estimated costs and income 1.5 describe procedures for negotiating superseded budgets 1.6 describe skills needed for agreeing budgets.

Learning outcome
The learner will: 2. be able to agree a budget
Assessment criteria
The learner can: 2.1 identify financial resources needed to achieve goals and objectives for agreeing a budget 2.2 evaluate and justify costs and risks 2.3 prepare a draft budget 2.4 negotiate and agree a budget.

Unit 492 Make decisions in a business environment

UAN:	**H/601/2560**
Level:	4
Credit:	4
GLH:	24
Relationship to NOS:	This unit directly relates to the Business and Administration NOS BAG122.
Endorsement by a sector or regulatory body:	This unit has been developed by the Council for Administration
Aim:	This unit is about making decisions made in a business environment at the level where there is no requirement for formal legal or organisational procedures to be followed.

Learning outcome
The learner will: 1. understand the purpose and process of decision-making
Assessment criteria
The learner can: 1.1 evaluate situations where decision-making is required 1.2 explain key stages in the decision-making process.

Learning outcome
The learner will: 2. understand how to prepare to make decisions
Assessment criteria
The learner can: 2.1 explain the purpose of knowing the context in which a decision is being made 2.2 justify possible limitations on a person making decisions 2.3 explain how to research information to be used to inform and influence decision-making 2.4 evaluate sources of information that can be used to inform and influence decision-making.

Learning outcome
The learner will: 3. understand how to make decisions
Assessment criteria
The learner can: 3.1 explain the purpose of meetings and other discussions where decisions are being made 3.2 explain how to structure own ideas, information and recommendations to maximise their effectiveness 3.3 explain the purpose and benefits of respecting other people's contributions to the decision-making process 3.4 explain how to be proactive and engage with colleagues during the decision-making process 3.5 justify the use of evidence, argument, questioning and assertiveness to influence outcomes 3.6 explain the purpose of collective responsibility.

Learning outcome
The learner will: 4. understand how to assess decisions and their effects
Assessment criteria
The learner can: 4.1 evaluate ways to monitor the effect of decisions and identify learning points 4.2 explain how to review the decision-making process.

Learning outcome
The learner will: 5. be able to prepare background information to make decisions
Assessment criteria
The learner can: 5.1 research and collect information to add value to the decision-making process 5.2 evaluate sources of information needed.

Learning outcome
The learner will: 6. be able to make decisions
Assessment criteria
The learner can: 6.1 identify and agree criteria for making a decision 6.2 review information provided in order to make a decision 6.3 structure ideas, information and recommendations in a logical and meaningful way 6.4 present rationale and conclusions to others using accurate and current information 6.5 provide additional information to support conclusions 6.6 respond as required when asked to supply information to help with decision-making 6.7 respect other people's contributions to the decision-making process 6.8 use evidence, argument, questioning and assertiveness to justify decision(s) 6.9 listen to other people's feedback and record for future evaluation 6.10 confirm support for the decision(s).

Learning outcome
The learner will: 7. be able to assess contributions to decision-making
Assessment criteria
The learner can: 7.1 assess contributions made to the decision-making process 7.2 identify learning points to improve future decision-making.

Unit 493 Negotiate in a business environment

UAN:	**K/601/2561**
Level:	4
Credit value:	7
GLH:	40
Relationship to NOS:	This unit directly relates to the Business and Administration NOS BAG124.
Endorsement by a sector or regulatory body:	This unit has been developed by the Council for Administration
Aim:	This unit is about preparing for, and carrying out negotiations with other parties, in a business environment.

Learning outcome
The learner will: 1. understand how to prepare for negotiations
Assessment criteria
The learner can: 1.1 explain the main principles of negotiation 1.2 explain the process of negotiation and how it is used in business 1.3 outline commercial and ethical frameworks that are important in negotiations 1.4 analyse the purpose and benefits of different negotiation strategies and techniques 1.5 explain the value of understanding the roles and levels of responsibility of other negotiators 1.6 explain the purpose and benefits of understanding the objectives of the other negotiators 1.7 explain the purpose of understanding own level of responsibility and authority in negotiations 1.8 explain the purpose and benefits of research and preparation before negotiations 1.9 analyse how differences in culture may impact on negotiations 1.10 explain the purpose and benefits of having clear and realistic objectives for negotiations 1.11 explain the purpose and benefits of having compromise positions.

Learning outcome
The learner will: 2. understand how to conduct negotiations
Assessment criteria
The learner can: 2.1 explain the purpose and benefits of being flexible during negotiations while seeking to achieve the main objectives 2.2 explain the purpose of keeping to the brief during negotiations 2.3 explain the purpose of keeping to own level of authority during negotiations 2.4 explain the purpose of referring issues to others, where required 2.5 explain the purpose and benefits of keeping goodwill during negotiations, and ways of doing so.

Learning outcome
The learner will: 3. understand how to complete negotiations
Assessment criteria
The learner can: 3.1 explain the purpose and benefits of achieving a 'win-win' outcome 3.2 explain the purpose of keeping an accurate record of negotiations, and agreeing the record 3.3 explain the purpose of withdrawal from negotiations, where needed.

Learning outcome
The learner will: 4. be able to prepare for negotiation
Assessment criteria
The learner can: 4.1 prepare a negotiating brief 4.2 identify and prioritise objectives and compromise positions 4.3 identify objectives other negotiators may have 4.4 research and assess the strength of the other negotiators 4.5 identify potential problems in negotiations and suggest solutions to overcome them 4.6 make sure all involved in the negotiations are fully briefed and prepared.

Learning outcome
The learner will: 5. be able to conduct negotiations
Assessment criteria
The learner can: 5.1 carry out negotiations in line with the commercial and ethical frameworks of an organisation 5.2 carry out negotiations within limits of own authority 5.3 make proposals which meet personal / organisational objectives, and those of the people being negotiated with (where possible) 5.4 adapt negotiation strategy to obtain results that meet minimum or agreed outcomes 5.5 clarify other people's understanding, and respond to their queries and objections 5.6 suggest solutions to deal with problems 5.7 refer the negotiations when matters arise which require authorisation 5.8 carry out negotiations in a way that creates goodwill and promotes a positive image of an organization.

Learning outcome
The learner will: 6. be able to complete negotiations
Assessment criteria
The learner can: 6.1 reach an agreement to the satisfaction of all those involved in the negotiations, where possible 6.2 maintain clear and correct records of the negotiations and agree them with all involved 6.3 withdraw from negotiations to re-consider current position, if necessary 6.4 complete negotiations in a way that creates goodwill and promotes a positive image of an organization.

Unit 494 Prepare specifications for contracts

UAN:	**F/601/2565**
Level:	4
Credit value:	5
GLH:	30
Relationship to NOS:	This unit directly relates to the Business and Administration NOS BAF132.
Endorsement by a sector or regulatory body:	This unit has been developed by the Council for Administration
Aim:	This unit is about understanding, and preparing the information that is needed to award a contract for work.

Learning outcome
The learner will: 1. understand work contracts
Assessment criteria
The learner can: 1.1 explain the purpose and benefits of contracts and other forms of agreement 1.2 describe different types of contracts and agreements 1.3 evaluate different types of contract and agreement for their intended purpose 1.4 explain the purpose of legal, regulatory and organisational requirements that may govern contracts 1.5 identify a range of terminology used in contracts and explain its purpose 1.6 explain the purpose and benefits of requirements and specifications in contracts.

Learning outcome
The learner will: 2. understand how to prepare for selection
Assessment criteria
The learner can: 2.1 explain the purpose and benefits of prioritising requirements 2.2 explain the purpose and value of developing objective selection criteria.

Learning outcome
The learner will: 3. be able to prepare specifications for work
Assessment criteria
The learner can: 3.1 identify requirements for contractor(s), consulting with others where required 3.2 prioritise requirements and prepare specifications for the products and services to be provided, consulting with others where required.

Learning outcome
The learner will: 4. be able to agree selection criteria
Assessment criteria
The learner can: 4.1 prepare selection criteria 4.2 agree selection criteria, where required.

Unit 495 Leading workplace organisation activities

UAN:	**F/600/5406**
Level:	4
Credit value:	10
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 04: Leading workplace organisation activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead the application of a systemic approach to continuously making improvements to the workplace organisation. It involves leading the activities that apply the principles and processes of workplace organisation (such as 5S or 5C). The learner will need to set standards and guidelines for the work area and its activity to determine where information, materials, tools and/or equipment are missing or require a new location and what improvements to the area or activity could be made. The learner will be expected to lead the production and/or updating of standard operating procedures and visual controls for the work area, which could cover such things as producing shadow boards to standardise the storage and location of area equipment, colour coding of equipment, cleaning and maintenance of equipment, production operations, and health and safety. The overall objective of the activity will be to make measurable improvements to the workplace organisation. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot solve, or that are outside their responsibility,

to the relevant authority. The learner will be expected to take full responsibility for their own actions, and the actions of others under their responsibility within the activity, and for the quality and accuracy of the work they carry out.

The learner's knowledge will provide a good understanding of the workplace organisation activity and the area in which they are working, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles of workplace organisation and their application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead workplace organisation activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within the learner's area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 lead the activities that apply the principles and process of workplace organisation within the work areas, and establish the area scores 1.4 set standards and guidelines for situations where information, resources or equipment is missing or is in surplus and where

improvements can be made

1.5 lead the team activities that make improvements to workplace organization

1.6 lead the production and/or updating of standard operation procedures and visual controls that everyone works to within the area

1.7 lead the production and/or updating of standard operation procedures which cover three of the following:

a. cleaning of equipment/work area
b. maintenance of equipment
c. health and safety
d. process procedures
e. manufacturing operations/working processes
f. quality systems
g. regulatory compliance system

1.8 lead the production and/or updating of changes to visual controls, which cover three of the following:

a. producing shadow boards or an alternative (such a labelled racking and storage systems to standardise the storage and location of area resources and/or equipment
b. colour coding
c. line status systems (such as line, process system)
d. skills matrix
e. performance measures
f. process control boards
g. improvement systems
h. planning systems

1.9 make measurable improvements to the workplace organization.

Learning outcome
The learner will: 2. know how to lead workplace organisation activities
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the workplace organisation activity 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the factors to be considered when selecting a work area for an activity (to include: cleanliness, health and safety, product quality, equipment and organisation) 2.4 explain how to plan the resources and time needed to carry out the agreed activity 2.5 describe the procedure used to identify and address surplus or missing equipment or resources (such as carrying out a 'red tagging' exercise) 2.6 explain how to arrange and label the necessary resources or equipment for rapid identification and access 2.7 explain how to correlate information to create or update standard operating procedures or other approved documentation 2.8 explain how to evaluate and prioritise the improvements required for the workplace 2.9 explain how to score and audit the workplace organisation 2.10 describe the techniques required to communicate information using visual control systems (such as shadow boards, performance charts, kpi's) 2.11 describe the extent of the learner's own authority, and to whom they should report in the event of problems that they cannot resolve.

Unit 496 Leading continuous improvement (Kaizen) activities

UAN:	**M/600/5420**
Level:	4
Credit value:	14
GLH:	32
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 05: Leading continuous improvement (Kaizen) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading continuous improvement (Kaizen) activities in the workplace. It involves approving the plan for the Kaizen process for the agreed work area/activity, to include plan, do, check, act, and to agree quantifiable objectives and targets for the improvement activity. The activities undertaken will include the identification of all forms of waste, and problems or conditions within the work area or activity where improvements can be made. The learner will need to focus on leading the improvement activities which would give business benefits such as reduced product cost, increased capacity and/or flexibility, improved safety, improved regulatory compliance, improved quality, improved customer service, improvements to working practices and procedures, reduction in lead time and reduction/elimination of waste. The learner will also be required to lead the production of changes to standard operating procedures (SOPs), which could include cleaning of equipment, maintenance of equipment, health and safety practices and procedures, process procedures, manufacturing operations and quality improvements.

The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of the Kaizen activity and the area in which they are working, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the Kaizen principles and their application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead continuous improvement (kaizen) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within the learner's area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 approve the plan for the kaizen process to the agreed work

area/activity to include plan, do, check, act

1.4 agree objectives and targets for the kaizen activity

1.5 lead the carrying out of the kaizen activity within the chosen work area/activity

1.6 confirm waste, problems or conditions within the work area or activity and discuss and evaluate what improvements can be made

1.7 confirm and lead improvements within the working area/activity which cover three of the following:

a. reduction in cost
b. improved health, safety and/or working environment
c. improved quality
d. improved regulatory compliance
e. improvements to working practices
f. reduction in lead time
g. reduction in waste and/or energy usage
h. improved customer service
i. improved resource utilisation

1.8 lead a structured waste elimination activity, based on the identified wastes, problems or conditions

1.9 lead the production of and approve changes to standard operating procedures (sops), or other approved documentation that will sustain the improvements resulting from the kaizen activity

1.10 confirm and lead improvements, which cover three of the following:

a. cleaning of equipment or work area
b. maintenance of equipment
c. health and safety
d. process procedures
e. manufacturing operations or work area operations
f. quality system
g. regulatory compliance systems

1.11 agree calculated measures of performance for quality, cost and delivery

1.12 agree calculations for one of the following quality measures:

a. not right first time (as a percentage or as parts per million (PPM))
b. company-specific quality measure

1.13 agree calculations for one of the following measures:

a. delivery schedule achievement
b. company-specific delivery or service measure

1.14 agree calculations for one of the following cost measures:

a. parts per operator hour (PPOH)
b. production volume
c. value added per person (VAPP)
d. overall equipment effectiveness (OEE)
e. stock turns
f. floor space utilization (FSU)
g. cost breakdown (such as labour, material, energy and overhead)
h. company-specific cost measure

1.15 approve the calculations and lead the development of a visual representation of the optimum resources required for a process

based on customer demand

1.16 evaluate comparisons of the agreed work area/activity before and after the kaizen activity to confirm improvements using key performance indicators

1.17 show business improvements, using one of the following key performance indicators:

a. not right first time (as a percentage or as parts per million (PPM))
b. company-specific quality measure
c. delivery schedule achievement
d. company-specific delivery measure
e. parts per operator hour (PPOH)
f. production volume
g. value added per person (VAPP)
h. overall equipment effectiveness (OEE)
i. stock turns
j. floor space utilization (FSU)
k. cost breakdown (such as labour, material, energy and overhead)
l. company-specific cost measure

Learning outcome

The learner will:

2. know how to lead continuous improvement (kaizen) activities

Assessment criteria

The learner can:

2.1 describe the health and safety requirements of the area in which they are leading the kaizen activity

2.2 explain how a work area/activity is selected for the kaizen activity

2.3 explain how to plan the resources and time needed to carry out the agreed activity

2.4 describe the principles for the deployment of kaizen (such as where a culture focuses on sustained continuous improvement, aiming at eliminating waste in all systems and processes in the organisation and supply chain)

2.5 describe the eight wastes (over-production, inventory, transport, over-processing, waiting time, operator motion, bad quality, failure to exploit human potential) and how to eliminate them

2.6 explain problem solving and root cause analysis

2.7 describe the importance of understanding the process/activity under review, and how this will affect the quality of the problem solving

2.8 describe the application of the deming cycle (plan, do, check, act)

2.9 explain how to carry out a kaizen activity and establish measurable improvements

2.10 explain how to distinguish facts from opinions in order to identify improvement actions

2.11 explain how improvements to the process are achieved by engaging the knowledge and experience of the people involved in the process

2.12	explain how to encourage people to identify potential improvements
2.13	explain how to evaluate improvement ideas in order to select those that are to be pursued
2.14	explain how to set quantifiable targets and objectives
2.15	explain how to produce/propose the creation of or changes to standard operating procedures (sops) or other approved documentation
2.16	describe the techniques used to visually communicate the work of the kaizen activity to participants and others
2.17	describe the application of the business' key measures of competitiveness (such as the former dti's seven measures: delivered right first time, delivery schedule achievement, people productivity, stock turns, overall equipment effectiveness, value added per person, floor space utilisation)
2.18	explain how the cycle time of a process can be defined.
2.19	how to calculate the required production rate for a process by using a calculation (such as takt time)
2.20	explain how to calculate the optimal resources (such as people, equipment, facilities and materials) required for a process based on customer demand
2.21	describe the techniques used to distribute work content to balance cycle times to the rate of customer demand, and how to visually represent it (e.g. line balance and process displays)
2.22	describe the extent of the learner's own authority, and to whom they should report to in the event of problems that they cannot resolve

Unit 497 Leading the development of visual management systems

UAN:	**M/600/5434**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 06: Leading the development of visual management systems (Suite 4))
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the development of visual management systems. It involves discussing and justifying the appropriate parts of the process or work area that will have visual controls and agree the key performance indicators which are to be displayed in the work area. The learner will also be required to monitor the effectiveness of the visual management system and to check the quality of the information that is being displayed. The information to be displayed will include such things as safety, zero defects, process concerns or corrective actions, performance measures, standard operating procedures (SOPs), workplace organisation, skills matrices, autonomous maintenance worksheets, parts control systems, problem resolution (e.g. Kaizen boards), shadow boards and standard work-in-progress (WIP) locations and quantities. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will be expected to take full responsibility for their own actions within the activity, and for the

quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and procedures of visual management, and its application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the development of visual management systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 consider and justify the appropriate parts of the process or work area that will have visual controls 1.4 approve and lead the making of changes to visual management systems 1.5 agree the key performance indicators that will be displayed in the work area 1.6 lead the production of and approve changes to standard operating procedures (sops), and visual controls that everyone works to within the area

1.7 lead the creation and updating of visual management systems that promote six of the following:
   a. health and safety
   b. quality/zero defects
   c. process concerns or corrective actions
   d. performance measures
   e. standard operating procedures
   f. workplace organisation
   g. skills matrices
   h. autonomous maintenance worksheets
   i. parts/material control systems
   j. problem resolution (eg, Kaizen boards)
   k. shadow boards
   l. standard work-in-progress (WIP) locations and quantities
   m. planning systems
   n. the delivery of effective meetings

1.8 monitor the effectiveness of the visual management system and check the quality of information being displayed

Learning outcome
The learner will: 2. know how to lead the development of visual management systems
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the work area in which they are leading the visual management activities 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the factors to be considered when selecting a visual management 2.4 explain where to find the information required to develop a local visual management system 2.5 describe the visual management systems available to create 'the visual factory' (such as using kanban systems, card systems, colour coding, floor footprints, graphs, team boards) 2.6 explain how to differentiate between business performance measures and local performance measures 2.7 describe the measures of performance in a lean business environment (such as health, safety and the environment, right first time, cost, delivery, responsiveness, process concerns and corrective actions, performance measures, workplace organisation) 2.8 describe the application of measurement techniques required for communicating the visual management within an area and to others who may use the information (such as target versus actual, % right first time, pareto analysis, bar charting, action plans, paynter charts) 2.9 describe the extent of the learner's own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 498 Leading the creation of flexible production and manpower systems

UAN:	**K/600/5447**
Level:	3
Credit value:	9
GLH:	60
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 07: Leading the creation of flexible production and manpower systems (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the creation of flexible business systems. It involves leading the application of the principles and processes of creating flexible production and manpower systems to the chosen activity. This will include obtaining and approving the schedule and batch size for the parts in the work area, and leading the creation of level schedules for those parts. The activities will require the learner to identify and evaluate improvement opportunities, and waste which needs to be removed, in order to achieve Takt time and flow processing. The learner will also be required to direct the production of a visual representation for identifying which resources do not meet the Takt time requirements. This would typically cover areas such as standard work in progress, consignment stocks, part routers, physical control signals, number of people required and their flexibility, and the rules and disciplines of the pull system. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will be expected to take full responsibility for their

own actions, and the actions of others under their responsibility within the activity, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and procedures of creating flexible production and manpower systems, and their application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the creation of flexible production and manpower systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 lead the application of the principles and processes of creating flexible production and manpower systems to the chosen activity 1.4 lead the selection of three different parts or materials in the work area, and approve the calculations for the following: a. workload b. capacity of resource (equipment, people) c. takt time

1.5 obtain and approve the schedule and batch size for the parts or materials in the work area

1.6 lead the creation of level schedules for the parts in the work area

1.7 direct the production of a visual communication of the schedule, which includes:

a. workload
b. resource capacity
c. takt time for the work area

1.8 identify and evaluate improvement opportunities, and waste which needs to be removed, in order to achieve takt time and flow processing

1.9 lead the production of a local workforce flexibility matrix (skills matrix)

1.10 direct the production of a visual representation, identifying resources that do not meet the takt time requirements

1.11 implement the creation of a visually controlled system, based on the demand of subsequent processes for the chosen parts or materials, which includes four of the following:

a. standard work in progress
b. safety stocks
c. part or material routers
d. physical control signals
e. rules and disciplines of the implemented control system

1.12 implement a visually controlled system, based on the demand of subsequent processes for the chosen parts, and which improves the overall process effectiveness

Learning outcome
The learner will: 2. know how to lead the creation of flexible production and manpower systems
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the work area in which they are leading the activity 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the information required to create level schedules, load and capacity, takt time and batch sizes 2.4 describe the meaning of 'level schedules', and how to create them 2.5 explain how to create a load and capacity diagram 2.6 explain takt time, and how this is calculated 2.7 describe the application of standard work in progress 2.8 describe the application of visually controlled systems and signals, based on the demand of subsequent processes 2.9 describe the application of skills matrices 2.10 describe the application of consignment stocking 2.11 explain how to simplify working practices and reduce the human error risk 2.12 describe the consequences of introducing a new improved part/process/material router 2.13 explain problem solving and route cause analysis 2.14 describe the eight wastes (over-production, inventory, transport, over-processing, waiting time, operator motion, bad quality, failure to exploit human potential), and how to eliminate them 2.15 explain how to stabilise and then optimise equipment effectiveness 2.16 explain how to conduct a review of asset care/best practice effectiveness, and establish a robust routine of asset care and correct operation 2.17 describe the appropriate techniques that provides value to the customer (such as push-pull systems, single piece flow, just in time (jit), kanban, autonomation) 2.18 describe the techniques used to visually communicate the work done (such as level schedules, load and capacity diagrams, revised batch sizes, and takt time) 2.19 explain how to lay out an effective workplace, utilising recognised techniques (such as cellular manufacturing incorporating parallel lines or u-shaped cells) 2.20 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 499 Leading value stream mapping (VSM) activities

UAN:	**M/600/5563**
Level:	4
Credit value:	13
GLH:	32
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 11: Leading value stream mapping (VSM) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading value stream mapping (VSM) activities. It involves leading the application of the principles and processes of value stream mapping to the approved parts, using appropriate improvement tools and techniques. The learner will be expected to lead the creation of a current state map for the parts or materials chosen, and to confirm problems or conditions within the current state map where improvements can be made. Typically, the improvements will include improved workflow, improved lead time, improved quality, reduced waste and improved safety. The learner will also need to lead the production of future state maps, which include part or material flow through the process, information flow, inventory, set-up and cycle times for each operation, lead time for the part or material, value-adding percentage of lead time, delays which occur between each operation, Takt time and schedules for the chosen part or material, and customer and supplier ordering and delivery. The learner's responsibilities will require them to comply with organisational policy and procedures for the value stream mapping activities undertaken, and to report

any problems that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and procedures of value stream mapping, and its application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout

Learning outcome
The learner will: 1. lead value stream mapping (VSM) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within the learner's area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 approve the selection of appropriate parts or materials on which the activity is to be carried out 1.4 lead the value stream mapping process on the chosen parts, using appropriate improvement tools and techniques 1.5 lead the creation of and approve a current state map for the parts

or materials chosen to include all of the following:

a. part or material flow through the process
b. information flow
c. inventory
d. set-up and cycle times for each operation
e. lead time for the part or material
f. value-adding percentage of lead time
g. delays which occur between each operation
h. takt time and schedules for the chosen part
i. customer and supplier ordering and delivery

1.6 confirm problems or conditions within the current state map where improvements can be made

1.7 confirm opportunities for improvements and waste that needs to be removed, in order to create a future state map covering three of the following:

a. improved workflow
b. improved lead time
c. improved quality
d. improved safety
e. less inventory
f. improved flexibility
g. less waste/cost

1.8 lead the production of and approve a future state map to include all of the following:

a. part or material flow through the process
b. information flow
c. inventory
d. set-up and cycle times for each operation
e. lead time for the part or material
f. value-adding percentage of lead time
g. delays which occur between each operation
h. takt time and schedules for the chosen part
i. customer and supplier ordering and delivery

1.9 lead the implementation of the changes identified

Learning outcome
The learner will: 2. know how to lead value stream mapping (VSM) activities
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the value stream mapping activity 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 explain how a part is selected for a value stream mapping activity 2.4 explain from whom authority is gained for release of people and resources for the value stream mapping activity 2.5 explain how to structure and run a value stream mapping event 2.6 describe the principles and processes for the deployment of value stream mapping 2.7 explain how improvements to the process can be achieved 2.8 explain how to evaluate improvement ideas and select those that will give the greatest benefit for the least spend 2.9 explain how to set quantifiable objectives and targets for the future state maps 2.10 explain how to create standard operating procedures (sops) 2.11 describe the techniques used to visually communicate the information and results of the process 2.12 describe the techniques of problem solving and root cause analysis 2.13 explain systems lead time, how they differ from actual lead time, and how both are constructed 2.14 explain how to calculate takt time 2.15 describe the principles of increasing process capacity 2.16 explain what constitutes value adding and non-value adding activities 2.17 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 500 Leading statistical process control (SPC) activities

UAN:	**J/600/5665**
Level:	4
Credit value:	8
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 14: Leading statistical process control (SPC) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading statistical process control (SPC) activities. It involves leading the application of the principles and processes of SPC to an approved process, and the gathering of all the necessary data for analysis, in consultation with relevant people. The learner will be expected to lead the application of statistical process control, utilising statistical and graphical methods to represent the process conditions. Typically, these would focus on simple run charts, tally charts, bar charts, histograms, run charts, box plots time series charts, Pareto diagrams and stem and leaf plots. The learner will need to lead the basic statistical process control, identifying special cause versus common cause. The learner will also be expected to agree activities which will improve the process performance, and to approve an action plan to implement the improvements. Calculation of the capability of the process will focus on identifying and approving Cp and Cpk. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will be

expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and procedures of statistical process control, and its application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead statistical process control (SPC) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 work to, and ensure compliance with all the required process monitoring documentation and work instruction sheets 1.4 approve the process on which the process analysis is to be carried out 1.5 consult with relevant people and lead the gathering of the necessary data for analysis 1.6 lead the application of the principles and processes of statistical

process control to the chosen process

1.7 lead the performing of basic statistical process control, using appropriate tools and techniques

1.8 lead the use of statistical and graphical methods to represent the process conditions

1.9 approve the capability of the process, identifying:

a. Cp
b. Cpk

1.10 lead the production of charts for process and control information, to include three from:

a. simple run charts
b. tally charts
c. bar charts
d. histograms
e. box plots
f. time series charts
g. Pareto diagrams
h. stem and leaf plots
i. run charts

1.11 agree activities which will improve the process performance

1.12 approve the production of an action plan to implement the improvements

Learning outcome
The learner will: 2. know how to lead statistical process control (SPC) activities
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the process control activities 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 explain where process control fits within a continuous improvement environment 2.4 explain how process performance affects customer satisfaction and process costs 2.5 explain where and why statistical process control is used, the benefits, and how it is applied 2.6 describe the importance of standardisation within a process operation, and why process performance can only be determined when it is controlled 2.7 explain how process control can improve process performance 2.8 describe the benefits of prevention and detection 2.9 describe the two types of variation within a process (common cause, special cause), and the impact they have within the process 2.10 explain how to gather data and effectively analyse it; how the data can be used to communicate abnormalities within a process 2.11 describe the main types of control charts used for spc, their features and benefits, and how to construct and implement them 2.12 describe the meaning of a 'population' and a 'sample' 2.13 describe the measurements of central tendency and variability, and how they are calculated 2.14 describe the properties of a normal curve of distribution 2.15 explain how to create charts or diagrams (such as run charts, histograms, box plots, time series charts, pareto diagrams, and stem and leaf plots) 2.16 explain how to explain the terms and calculate mean, median, mode, standard deviation, range and variance 2.17 explain how to explain and calculate process capability (cp and cpk) 2.18 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 501 Leading value management (value engineering and value analysis) activities

UAN:	**A/600/5713**
Level:	4
Credit value:	11
GLH:	32
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 17: Leading value management (value engineering and value analysis) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading value management (value engineering and value analysis) activities. It involves leading the application of the principles and processes of value management (VM) to the chosen product or process. The learner will be expected to confirm what the customer requires from the product or the process, and to approve quantifiable objectives and targets to achieve this. The learner will need to lead the analysis of the functions of the process, agree costs of each of these functions, and confirm the added and non-value added activities within the process. The learner will also be expected to approve the most appropriate alternatives, lead a risk assessment of the alternatives, prioritise and rank the alternatives, and confirm the expected benefits. The learner will need to lead the development of these alternatives into detailed proposals that will improve the value of the product or process, and to provide costing recommendations for management approval. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot

solve, or that are outside their responsibility, to the relevant authority. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and processes of value management, and its application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead value management (value engineering and value analysis) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 lead the application of the principles and processes of value management (vm) to the chosen product or process 1.4 confirm what the customer requires from the product or the process, and approve quantifiable objectives and targets for the value management activity

1.5 lead the analysis of the functions of the product or process being studied, and agree allocated costs to those functions

1.6 lead the production of a total cost model and supply chain map for the product or process, which shows how cost are related to function

1.7 confirm the non-value added activity within the product or process, and approve alternatives

1.8 lead the development of these alternatives into detailed proposals that will improve the value of the product or process

1.9 lead the production of detailed proposals of the findings of the value management activities which:

a. identify the non-value added activities and indicate alternatives
b. prioritise and rank the alternatives
c. include a risk assessment of the alternatives
d. identify the most appropriate alternatives
e. provide costing recommendations for management approval
f. identify expected benefits

1.10 approve the new value added process, and manage the plan within agreed timescales

Learning outcome
The learner will: 2. know how to lead value management (value engineering and value analysis) activities
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the work area in which they are leading the value management activities 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 explain how to select a product or process on which to carry out the value management activity 2.4 explain how to structure and run a value management activity 2.5 explain how to set quantifiable objectives and targets for the value management activity 2.6 explain how to carry out a function analysis 2.7 describe the performance related tools used to qualify customer wants and needs 2.8 describe the 'cost of function' equation, and how to calculate the cost of function 2.9 explain fast diagramming and value trees 2.10 explain decision making and creativity techniques (brainstorming) 2.11 explain how value management relates to the overall business strategy and competitive positioning 2.12 explain how to produce a total cost model and supply chain map for the product or process 2.13 explain what constitutes value adding and non-value adding activities 2.14 explain how to identify what a customer requires from a product or process 2.15 explain how to prioritise and rank the alternatives 2.16 explain how to complete a risk assessment of the alternatives 2.17 explain how to prepare the findings into proposals 2.18 explain how to monitor and track proposals to implementation 2.19 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 502 Leading failure modes and effects analysis (FMEA) activities

UAN:	**L/600/5733**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 18: Leading failure modes and effects analysis (FMEA) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading failure modes and effects analysis (FMEA) activities. It involves leading the principles and processes of FMEA and agreeing the key features of FMEA required for the activity under investigation. The activities will include concepts, designs, systems, products, processes and machines. The learner will be required to agree the key features of FMEA, check the recording of the information gathered in an appropriate format, and consider and approve valid judgements about the activity, using FMEA principles. This will include approving risk priority numbers (RPNs), agreeing high RPNs and agreeing actions to improve them. Once actions have been completed, the learner will need to lead the reassessment of the activity and review the re-score of severity, occurrence and detection. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they can not solve, or that are outside their responsibility, to the relevant authority. The learner will need to ensure that all the necessary documentation is

completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of FMEA, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of FMEA, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead failure modes and effects analysis (FMEA) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 agree the key features of failure modes and effects analysis required for the activity under investigation 1.4 lead the carrying out of a failure modes and effects analysis on two of the following: a. concept b. product c. design

d. process
e. system
f. machine

1.5 agree, for the activities analysed:
a. the potential failure modes
b. the potential effects from failure modes
c. the potential causes of failure modes

1.6 co-ordinate the production of a failure modes and effects analysis

1.7 check the recording of the information gathered in an appropriate format

1.8 approve the score for all of the following:
a. the likely occurrence of a potential failure modes
b. the severity of the potential failure modes
c. the likelihood of detection of the potential failure modes

1.9 consider and approve valid judgements about the activity using failure modes and effects analysis principles

1.10 approve the risk priority numbers (rpns) calculations, agree high rpns, and agree actions to improve them

1.11 check rating tables for all of the following:
a. occurrence
b. severity
c. detection

1.12 lead the reassessment of a failure modes and effects analysis once actions have been completed, and review the re-score of severity, occurrence and detection

Learning outcome
The learner will: 2. know how to lead failure modes and effects analysis (FMEA) activities
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the failure modes and effects analysis 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the main features and benefits of carrying out a failure modes and effects analysis 2.4 explain who should be part of a team that constructs and updates a failure modes and effects analysis 2.5 explain system FMEA, concept FMEA, design FMEA and process FMEA - what they are, and where they should use them 2.6 describe the meaning of failure mode, failure effect and failure cause 2.7 describe the rating scale used in failure modes and effects analysis projects, to include the severity rating scale, the occurrence rating scale and the detection rating scale 2.8 explain how to calculate a risk priority number (rpn) 2.9 explain how to use the risk priority numbers 2.10 explain how to apply a structured approach to risk reduction 2.11 explain when to start a failure modes and effects analysis 2.12 explain when to update a failure modes and effects analysis 2.13 describe the roles and responsibilities of individuals within a failure modes and effects analysis team 2.14 describe the extent of their own authority within the project, and to whom they should report in the event of problems that they cannot resolve

Unit 503 Leading measurement systems analysis (MSA) activities

UAN:	**R/600/5748**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 19: Leading measurement systems analysis (MSA) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading measurement systems analysis (MSA) activities. It involves approving an appropriate measurement system on which to carry out the analysis, and obtaining and approving all the necessary data in order to carry out the measurement systems analysis. The learner will be expected to lead the application of the principles and processes of measurement system analysis, which will include such things as directing the completion of a calibration study on a gauge, leading a gauge linearity study, leading either an attribute or a variable gauge repeatability and reproducibility study, directing a metrology study on a measurement system which includes either a variable or attribute gauge repeatability and reproducibility study. The learner will be required to lead the carrying out of the analysis using the appropriate techniques, and to confirm the recording of the results of the analysis in the appropriate format. From this information, they will need to confirm the percentage gauge repeatability and reproducibility of the measurement system under study, and to lead the production of a detail report suggesting ways in which the measurement

system might be improved.

The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will need to ensure that all the necessary documentation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of measurement systems analysis, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of MSA, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead measurement systems analysis (MSA) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate)

i. monitor the progress of improvement activities
j. deal with any organisational problems identified during the improvement activity

1.3 approve the selection of an appropriate measurement system on which to carry out the analysis

1.4 lead the carrying out of a measurement system analysis, which includes three from the following:
a. completing a calibration study on a gauge
b. conducting a gauge linearity study
c. completing either an attribute or a variable gauge repeatability and reproducibility study
d. conducting a metrology study on a measurement system which includes either a variable or attribute gauge repeatability and reproducibility study

1.5 obtain and approve all the necessary data in order to carry out the measurement systems analysis

1.6 lead the carrying out of the analysis, using the appropriate techniques

1.7 agree the type of measurement system variation, to include two of the following:
a. bias
b. linearity
c. stability
d. accuracy
e. repeatability
f. reproducibility

1.8 confirm the recording of the results of the analysis in the appropriate format

1.9 agree the percentage gauge repeatability and reproducibility of the measurement system under study, and approve ways of improving the measurement system

1.10 lead the production of a measurement systems analysis report, detailing ways of improving the measurement system under study

Learning outcome
The learner will: 2. know how to lead measurement systems analysis (MSA) activities
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the measurement systems analysis 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 explain why we should study our measurement systems 2.4 explain how to select a measurement system for analysis 2.5 describe the possible sources of measurement systems variation 2.6 describe the use of measurement systems analysis, and how it can be used in a six sigma improvement project 2.7 explain how to conduct a variable and a attribute repeatability and reproducibility study 2.8 describe the terminology used in measurement system analysis (such as bias, linearity, stability, accuracy, repeatability, discrimination, resolution, reproducibility) 2.9 explain how to conduct a measurement systems analysis study 2.10 explain how to calculate gauge repeatability and reproducibility 2.11 explain how to calculate gauge precision and tolerance 2.12 explain industry rules for repeatability and reproducibility results 2.13 describe the extent of their own authority within the project, and to whom they should report in the event of problems that they cannot resolve

Unit 504 Carrying out design of experiments (DOE)

UAN:	**L/600/5862**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 20: Carrying out design of experiments (DOE) (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for carrying out design of experiments (DOE). It involves applying the principles and process of design of experiments to the selected plant or process, which will require the plant or process being taken out of production to run the methodology. The learner will need to calculate the correct sample size required and identify a suitable sampling plan to reduce any systematic errors. The learner will be expected to determine the scope/parameters of the experiment and carry out the experiment within these parameters utilising the appropriate tools and techniques. The results of the design of experiment will be recorded and analysed to identify areas where improvements to the process can be made. The learner will also need to produce a report of the findings along with an action plan to ensure the improvements identified are implemented. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, report any problems with the activities that they cannot solve or are outside their responsibility to the relevant authority. The learner will need to ensure that all sampling is carried out correctly and the necessary

job/task documentation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of design of experiments and provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of design of experiments in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. carry out design of experiments (DOE)
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 select an appropriate process on which to carry out the design of experiment and obtain all the necessary data 1.3 determine the scope/parameters of the experiment 1.4 utilise sample size selection to ensure the statistical validity of the experiment and calculate the correct sample size required for the experiment 1.5 estimate the resources and expected benefits for the design of experiment undertaken 1.6 document the resources required to include: a. financial b. time scales c. manpower d. plant/equipment e. materials 1.7 identify a suitable sampling plan to reduce systematic errors 1.8 carry out a design of experiment within an improvement project utilising the appropriate tools and techniques 1.9 for the experiment undertaken identify: a. a suitable Alpha risk level b. a suitable Delta that needs to be observed c. a suitable Beta level 1.10 determine the correct experimental design to use from one of the following: a. full factorial b. 2k factorial

c. fractional factorial

1.11 record the results of the design of experiment in the appropriate format

1.12 analyse the data gathered and identify areas where improvements to the process can be made

1.13 calculate and produce graphs for the following:

a. main effects

b. interactions

1.14 produce a design of experiment report which includes an action plan to ensure the improvements

Learning outcome
The learner will: 2. know how to carry out design of experiments (DOE)
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are carrying out an experiment 2.2 explain why we need to use design of experiments and how this benefits an improvement project 2.3 explain how to determine the scope of an experiment 2.4 explain how to carry out a design of experiment project and the tools and techniques used 2.5 explain where to obtain the data required to carry out the design of experiment 2.6 explain how to calculate the sample size to be used in the design of experiment 2.7 explain what is meant by alpha risk and beta risk 2.8 explain how to use the data obtained to calculate: mean, median, mode, standard deviation, range and variance 2.9 explain how to calculate and graphically display main effects and interactions 2.10 explain what is the meaning of a population and a sample in terms of the design of experiment 2.11 explain how to design a suitable array for the designs to include full factorial, 2k factorial and fractional 2.12 explain how to design an array to assess the selected interactions from the designs to include full factorial, 2k factorial and fractional 2.13 describe the extent of their own authority and whom they should report to, in the event of problems that they cannot resolve

Unit 505 Leading mistake/error proofing (Poka Yoke) activities

UAN:	**K/600/5867**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 21: Leading mistake/error proofing (Poka Yoke) activities (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading of mistake/error proofing (Poka Yoke) activities, which is a method of making an activity 'foolproof'. It involves leading the application of the principles and procedures of mistake/error proofing to the chosen activity, to enable worksheets to be produced for the activity that identify the problem, evaluate any actions to be taken, and indicate the benefits to be gained. Typically, worksheets would focus on the description of the mistake/error identified, the containment action taken, the root cause of the mistake/error and the permanent corrective action to be taken. The learner will be required to lead trials on the suggested improvements, which will include confirming their effectiveness, cost and complexity. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner need's to ensure that all necessary job/task documentation and analysed data is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy

of the work that they produce.

The learner's knowledge will provide a good understanding of mistake/error proofing, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of mistake/error proofing, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead mistake/error proofing (poka yoke) activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 use information and data to approve the selection of a suitable process on which the mistake/error proofing activity is to be carried out 1.4 lead the application of the mistake/error proofing process to the chosen activity 1.5 use appropriate techniques to analyse the data received, and confirm valid conclusions 1.6 evaluate recommendations and lead the production of worksheets for the activity that identify the problem and actions to be taken 1.7 lead the creation of a worksheet of the mistake/error proofing

activity, identifying:

a. the description of the mistake/error identified
b. the containment action taken
c. the root cause of the mistake/error
d. the permanent corrective action to be taken

1.8 agree suitable solutions, and manage the carrying out of agreed trials to measure the effectiveness of the solution

1.9 approve suitable solutions and determine their:

a. effectiveness
b. cost
c. complexity

1.10 confirm and co-ordinate the implementation of the optimum solution

1.11 lead the measurement and documentation of the results

1.12 identify the benefits of mistake/error proofing in terms of:

a. improved quality/compliance (such as ISO9001)
b. reduced costs
c. delivery or service

Learning outcome
The learner will: 2. know how to lead mistake/error proofing (poka yoke) activities
Assessment criteria
The learner can: 2.1 explain how to define a mistake/error proofing activity, and the benefits of carrying this out 2.2 describe the difference and benefits between mistake/error proofing and prevention and detection 2.3 explain how to plan the resources and time needed to carry out the agreed activity 2.4 describe the selection criteria used to determine a suitable product or process on which to carry out the mistake/error proofing activity 2.5 explain how mistake/error proofing can lead to zero defects 2.6 describe the relationship between errors and defects 2.7 describe the different types and range of mistakes 2.8 explain how defects originate in products or processes 2.9 explain how the role of source inspection contributes to the reduction of defects 2.10 describe the application of mistake/error proofing (poka yoke) tools (such as 'cause and effect', and the 5 'why's) 2.11 describe the type of mistake/error proofing documentation, and the information it should contain 2.12 describe the analysis and charting methodology used for mistake/error proofing 2.13 describe the financial implications of mistake/error proofing projects 2.14 describe the relationship between mistake/error proofing and other continuous improvement processes (such as workplace organisation 5s/5c, quick changeovers, cellular manufacturing, total productive maintenance, structured problem solving and visual management) 2.15 explain how to undertake trials and measure the effectiveness of mistake/error proofing projects 2.16 describe the different types and range of mistake proofing devices used 2.17 describe the roles and responsibilities of individuals within a mistake/error proofing team (including facilitator, timekeeper, scribe) 2.18 describe the extent of their own authority within the activity, and to whom they should report in the event of problems that they cannot resolve

Unit 506 Applying quality function deployment (QFD)

UAN:	**J/600/5875**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 22: Applying quality function deployment (QFD) (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for applying quality function deployment (QFD). It involves identifying the customer requirement of a product or process and obtaining all the required information necessary to perform the QFD project study. These, typically, would cover the needs and expectations of the customer and the functions and features required by the customer. The learner will be required to produce a matrix for the quality function deployment activity, which identifies the four phases (e.g. pre- planning, design deployment, process and production planning and managing deployment). The learner will need to analyse the information gathered (such as score matrices for relationships, technical requirements, correlations, planning and specifications) and draw conclusions as to the appropriate course of action. The learner will be expected to record the results of the analysis in the appropriate format to enable a report to be compiled, outlining the findings of the activity and the recommended solutions. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken and to report any problems with the

activities that they cannot solve, or are outside their responsibility, to the relevant authority. The learner will need to ensure that all the necessary documentation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of quality function deployment and provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of QFD, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. apply quality function deployment (QFD)
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 identify the customer requirement of a product or process using quality function deployment 1.3 obtain all the required information necessary to perform the quality function deployment study 1.4 produce a matrix for a quality function deployment project which identifies the four phases as follows: a. pre-planning b. design deployment c. process and production planning d. managing deployment 1.5 determine the customer requirements within the project in terms of: a. needs and expectations b. functions c. features 1.6 carry out the quality function deployment project 1.7 identify within the quality function deployment project the: a. necessary inputs and how to acquire them b. the outputs from each of the four phases and their execution c. customer rankings d. substitute quality characteristics 1.8 analyse the information gathered and draw conclusions as to the

appropriate course of action

1.9 record the results of the analysis in the appropriate format

1.10 produce and score matrices for three of the following:

a. relationships
b. technical requirements
c. correlations
d. planning
e. specifications

1.11 produce a report outlining the findings and the recommended solutions

Learning outcome
The learner will: 2. know how to apply quality function deployment (QFD)
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are carrying out the quality function deployment activity 2.2 describe the advantages of using quality function deployment 2.3 describe the 'quality lever' and how quality function deployment fits this model 2.4 describe the terms 'house of quality' and 'voice of the customer' 2.5 explain how quality function deployment relates to potential failure modes and effects analysis, design of experiments, value analysis, control plans, pugh concept diagrams 2.6 explain how to carry out a quality function deployment activity, and the tools and techniques used 2.7 describe the four phases of quality function deployment (pre-planning, design deployment, process and production planning, managing deployment) 2.8 explain how to identify the necessary inputs and outputs for each of the phases 2.9 explain what are the customer's requirements within the project, in terms of needs and expectations, features and functions 2.10 explain how to produce matrices for relationships, specifications, technical requirements and planning 2.11 explain how to score the matrices within the quality function deployment 2.12 describe the extent of their own authority within the project and whom they should report to, in the event of problems they cannot resolve

Unit 507 Leading the creation of standard operating procedures (SOP)

UAN:	**F/600/5888**
Level:	4
Credit value:	8
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 23: Leading the creation of standard operating procedures (SOP) (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required to lead the creation of standard operating procedures (SOP) for work activities. This will involve leading the documenting of the information gathered from the method used when performing the operation/process. The learner will lead the preparations required from start to finish, advise on the quality and safety standards to be maintained, and agree on the drawings, tooling, fixtures, gauges, and other items that are used during the operation or process. The learner will need to agree the 'key points' in the document, and advise on the use of drawings, photographs and/or sketches, as appropriate. The learner will be required to ensure that those involved in performing the operation or process have the opportunity to contribute, and agree the method identified. The learner will also be required to lead the production of standard operating procedures for a range of activities, such as cleaning of equipment, maintenance of equipment, health and safety practices and procedures, process procedures, manufacturing operations and quality

improvements.

The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and procedures for creating standard operating procedures, and their application, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the creation of standard operating procedures (SOP)
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity

1.3 lead the production of a standard operating procedure for two of the following:
   a. cleaning of equipment
   b. maintenance of equipment
   c. health, safety and environmental practices and procedures
   d. process procedures
   e. manufacturing operations
   f. quality improvements
   g. improvements to customer satisfaction

1.4 lead the production of standard operating procedures that include all of the following:
   a. operation/process to be performed
   b. part/product number and part/product description/operation reference
   c. operation/process number
   d. preparation activities prior to starting the operation/process
   e. description of the full operation/process, broken down into appropriate tasks/activities
   f. quality standards, health and safety requirements, environmental issues/requirements
   g. tooling/fixtures/gauges/equipment required
   h. sketches/photographs/drawings that assist completion of the operation/process
   i. date of first issue
   j. originator of the document
   k. latest revision date

1.5 lead the gathering of information of the current operation or process to identify the optimum and safest method

1.6 agree what tools, equipment, fixtures, documentation and standards are required

1.7 ensure that all team members performing the operation or process have the opportunity to contribute, and agree the method identified

1.8 lead the production of standard operating procedures in an agreed format and monitor their accuracy against the operation or process requirements

1.9 lead the production of standard operating procedures that minimise all of the following:
   a. time
   b. effort
   c. waste

1.10 arrange for the supply of standard operating procedures at their point of use, and the storage of copies and master copies in accordance with company requirements

1.11 lead the revision of standard operating procedures, as appropriate, to ensure their effectiveness in the workplace

1.12 establish confirmation that the method defined will meet quality, productivity, health, safety and environmental requirements

Learning outcome
The learner will: 2. know how to lead the creation of standard operating procedures (SOP)
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area for which they are leading the creation of standard operating procedures (SOP) 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the various formats used in creating sop 2.4 explain where to find the sop document format to be used in their business 2.5 describe the information that will be required to create a sop 2.6 explain how sop are structured, and the importance of their use 2.7 explain methods of communicating/facilitating to ensure that all the required information for the sop is captured 2.8 describe the operation/process to be captured in the sop 2.9 explain why sop are the basis for quality and continuous improvement 2.10 describe the eight wastes (over-production, inventory, transport, over-processing, waiting time, operator motion, bad quality, failure to exploit human potential) and how to eliminate them 2.11 explain how to simplify work done, eliminating waste and potential for human error 2.12 explain takt time, and the relationship with achieving flow in a process 2.13 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 508 Leading the application of Six Sigma methodology to a project

UAN:	**D/600/5896**
Level:	4
Credit value:	14
GLH:	32
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 24: Leading the application of Six Sigma methodology to a project (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the application of a structured Six Sigma methodology to a project. It involves leading the identification of the Six Sigma organisational infrastructure, roles and responsibilities and business-specific metrics that will apply. These will include financial, quality and process aspects of the project. The learner will be expected to agree areas where the Six Sigma tools, techniques and activities can be applied, in order to demonstrate those factors that are critical to the customer, business and process. Contribution to the identification of the cost of poor quality by agreeing the defects per million opportunities (DPMO) is a major part of this unit. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they cannot solve, or that are outside your responsibility, to the relevant authority. The learner will need to ensure that all the five phases of Six Sigma are utilised within the project (such as define, measure, analyse, improve and control), and to ensure all necessary project

documentation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of the application Six Sigma methodology, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of Six Sigma methodology, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the application of six sigma methodology to a project
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 lead the application of the structured six sigma methodology and approach to the selected project 1.4 lead and participate in six sigma projects which cover two the following: a. manufacturing b. quality level

c. administration

1.5 lead the utilisation of the five phases of six sigma within the project:
   a. define
   b. measure
   c. analyse
   d. improve
   e. control

1.6 approve the six sigma organisational infrastructure, roles and responsibilities and business-specific metrics that would apply

1.7 lead the production of a diagram (family tree) of the six sigma organisational infrastructure and the roles of:
   a. Champion
   b. Mentor
   c. Yellow Belt
   d. Green Belt
   e. Black Belt
   f. Master Black Belt

1.8 lead the production of a metric chart for the six sigma projects undertaken:
   a. financial
   b. quality
   c. process

1.9 agree areas where the six sigma tools, techniques and activities can be applied, and direct the need to measure those factors that are critical to quality characteristic (ctqc) for the customer, business and process

1.10 identify the critical to quality characteristic (ctqc) of the projects, to include:
   a. cost
   b. quality
   c. delivery

1.11 contribute to the identification of the cost of poor quality, by agreeing the defects per million opportunities (dpmo)

1.12 establish defects per million opportunities to the sigma score, and determine the gap to six sigma performance

Learning outcome
The learner will: 2. know how to lead the application of six sigma methodology to a project
Assessment criteria
The learner can: 2.1 describe the six sigma methodology, and how it is applied to a project 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the six sigma infrastructure and philosophy 2.4 describe the benefits that will arise from a six sigma project 2.5 describe the 'parts per million opportunities' goal of six sigma 2.6 describe the calculation of defects per million opportunities (dpmo) 2.7 describe the five phases of six sigma that are applied to a project 2.8 explain how to define a critical to quality characteristic (ctqc) 2.9 explain how non-value added activity can serve as a roadblock for achieving zero defect 2.10 explain how to define an 'opportunity for defect' 2.11 describe the roles and responsibilities of the key players in the six sigma process (champion, mentor, master black belt, black belt, green belt and yellow belt) 2.12 describe the relationship between key process input variables (KPIV) and key process output variables (KPOV) (using the equation y=(f)x) 2.13 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve

Unit 509 Leading the carrying out of Six Sigma process mapping

UAN:	**T/600/5905**
Level:	4
Credit value:	14
GLH:	32
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 25: Leading the carrying out of Six Sigma process mapping (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the carrying out of a Six Sigma process mapping activity. It requires the learner to approve the selection of a suitable process on which to carry out the process mapping activity, and to agree the key stages that form the overall process under investigation. These would be the process input variables and the process output variables, and would include things which are controllable, critical, noise, and standard operating procedures. The learner will be required to lead the construction of the process map for the Six Sigma project and to confirm the value added and non-value added steps in the process. The learner will also need to consider the information gathered in the Six Sigma mapping activity, and to agree areas where improvements can be made to the process as a result of the information gathered. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they cannot solve, or that are outside their responsibility, to the appropriate authority. The learner must ensure that all the necessary

documentation/visual representation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of Six Sigma process mapping, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and the application of Six Sigma process mapping, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the carrying out of six sigma process mapping
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 approve the selection of a suitable process on which to carry out the process mapping activity 1.4 agree the key stages that form the overall process under investigation 1.5 lead the collection of the data necessary to construct the six sigma process map

1.6 lead the construction of the process map for the six sigma project
1.7 lead the production of a process map, which identifies:
  a. the key process input variables
  b. the key process output variables
1.8 confirm both the key process input variables and the key process output variables as one or more of the following:
  a. controllable
  b. critical
  c. noise
  d. standard operating procedure
1.9 confirm the value added and non-value added steps in a process
1.10 identify and agree improvements to the process as a result of the information gathered in the six sigma mapping activity
1.11 agree and have included on the process map the specifications of both the:
  a. key process input variables
  b. key process output variables

Learning outcome
The learner will: 2. know how to lead the carrying out of six sigma process mapping
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the process mapping activity 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the benefits of carrying out six sigma process mapping 2.4 explain what a six sigma process map is and how it is constructed 2.5 explain how the six sigma process map integrates within a six sigma project 2.6 describe what is meant by key process input variables (KPIVs) and key process output variables (KPOVs) 2.7 describe the data collection point for the key process input variables and key process output variables (such as gauges, forms and samples) 2.8 explain what the main types of key process input variables and key process output variables are in terms of being controllable, critical, noise, or standard operating procedures 2.9 explain who should create a six sigma process map 2.10 describe the difference between a value added activity and a non-value added activity 2.11 describe the roles and responsibilities of individuals within a process mapping team 2.12 describe the extent of their own authority within the project, and to whom they should report in the event of problems that they cannot resolve

Unit 510 Leading the application of basic statistical analysis

UAN:	**T/600/5919**
Level:	4
Credit value:	10
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 26: Leading the application of basic statistical analysis (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the application of basic statistical analysis, by consulting with the appropriate people and leading the gathering the relevant data for statistical analysis on a Six Sigma project. The learner will need to lead the use the data gathered to produce descriptive statistics, which cover mean, median, mode, standard deviation, range and variance for the selected representative sample. The learner will be expected to lead the recording of the statistics gathered, using a variety of techniques that could include bar charts, histograms, Pareto diagrams, stem and leaf diagrams, box plots and time series charts. The learner will also be required to approve the production of an action plan as a result of the statistical and graphical analysis undertaken. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they can not solve, or that are outside their responsibility, to the relevant authority. The learner will need to ensure that all the necessary documentation and/or visual representations are completed accurately and legibly. The learner will be

expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of basic statistics, and will provide an informed approach to the analytical techniques and procedures used. The learner will need to understand the principles and application of basic statistical analysis, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the application of basic statistical analysis
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 consult with appropriate people and lead the gathering of the relevant data for statistical analysis 1.4 direct the production of data gathering forms or charts to gather information to enable statistical and graphical analysis to take place 1.5 lead the recording of the collected data, utilising three of the following methods: a. bar charts

b. histograms
c. Pareto diagrams
d. stem and leaf diagrams
e. box plots
f. time series charts

1.6 lead the use of statistical and graphical analysis on a six sigma project

1.7 lead the production of descriptive statistics of data, to include all of the following:
a. mean
b. median
c. mode
d. standard deviation
e. range and variance

1.8 lead the production of a normal distribution to assess a population from the representative sample

1.9 interpret the statistical data collected, in order to validate and approve the pre-determined courses of action

1.10 approve the production of an action plan as a result of the statistical and graphical analysis undertaken

Learning outcome
The learner will: 2. know how to lead the application of basic statistical analysis
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the collecting of data 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the meaning of 'variation', how this can be detected with statistics, and how this variation can affect a process 2.4 describe the number of data points needed to draw a statistically valid conclusion 2.5 explain why we need to use basic statistics 2.6 describe the meaning of the terms 'population' and 'sample' when applied to basic statistics 2.7 explain distribution curves and the properties of a normal curve 2.8 explain how to create and use charts and diagrams (such as histograms, box plots, time series charts, pareto diagrams, stem and leaf diagrams) 2.9 explain how to calculate mean, median, mode, standard deviation, range and variance 2.10 describe the difference between descriptive and inferential statistics 2.11 describe the extent of their own authority within the project, and to whom they should report in the event of problems that they cannot resolve

Unit 511 Leading the application of Six Sigma metrics to a project

UAN:	**Y/600/5931**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 27: Leading the application of Six Sigma metrics to a project (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the application of Six Sigma metrics to products and processes. It involves consulting with appropriate personnel and leading the gathering all the necessary data to produce a metric graph. The learner will need to lead the application of Six Sigma metrics to monitor the process and justify improvements, approving both primary and secondary metrics for the Six Sigma project. The learner will be expected to direct the use of the data collected and the graph produced to identify and approve where improvements can be made, and to approve an action plan that will bring about the improvements. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the activities that they cannot solve, or that are outside their responsibility, to the relevant authority. The learner must ensure that all the necessary documentation/visual representation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity, and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of the production of Six Sigma metrics, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application of Six Sigma metrics, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the application of six sigma metrics to a project
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 lead six sigma metrics activities on both: a. products b. processes 1.4 consult with appropriate personnel and lead the gathering of the necessary data to produce a metric graph 1.5 for the selected activity, lead the application of six sigma metrics to monitor the process and justify improvements 1.6 confirm, for each of the activities covered: a. defects per million opportunities b. defects per unit

c. rolled through put yield (Yrt)
d. the sigma score

1.7 confirm and approve metrics, which are:
a. long-term
b. short-term
c. variable or attribute

1.8 approve both primary and secondary metrics for the six sigma project

1.9 agree where appropriate to transform variable data to attribute data

1.10 direct the use of the data collected to complete a primary metric graph

1.11 use the graph produced to identify and approve where improvements to metrics can be made

1.12 approve an action plan that will bring about the improvements

Learning outcome
The learner will: 2. know how to lead the application of six sigma metrics to a project
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the six sigma metrics activity 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 describe the main features and benefits of carrying out a six sigma metrics activity 2.4 describe the importance of using metrics to drive a six sigma project 2.5 explain how to calculate defects per million opportunities, defects per unit and rolled throughput yield 2.6 explain how to utilise z tables to calculate the sigma score 2.7 describe the time period necessary to calculate a meaningful baseline 2.8 explain how to set realistic objectives and targets for the six sigma metrics activity 2.9 explain how to gather the data required for inclusion in a metric chart 2.10 explain how to construct a six sigma metric chart 2.11 describe the relationship between 'parts per million', 'defects per million opportunities', yrt and the sigma score 2.12 describe the difference between variable and attribute data 2.13 explain why it is advantageous to transform attribute data into variable data 2.14 explain how to transform attribute data into variable data 2.15 describe the significance of the S shift, and how it can be utilised to infer long-term metric values 2.16 describe the extent of their own authority within the project, and to whom they should report in the event of problems that you cannot resolve

Unit 512 Leading the production of a characteristic selection matrix

UAN:	**R/600/5944**
Level:	4
Credit value:	9
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 28: Leading the production of a characteristic selection matrix (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the production of a characteristic selection matrix. It involves working with the customer to agree the customer requirements and manage the application of a characteristic selection matrix to the Six Sigma project to create greater customer satisfaction. The learner will need to lead the collection of the necessary data and lead the production of a characteristic selection matrix for the chosen activity by managing the five-step process for generating the matrix. This will require listing the customer key process output variables, scoring the key process output variables, listing the key process input variables that impact the customer key process output variables, numerically rating the interaction between key process input variables and customer key process output variables and using ranking to prioritise future team focus. The learner will then be expected to use this information to identify and approve activities in the process where improvements can be made. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken and to report any problems with the activities that they cannot solve or are outside their responsibility to the relevant

authority. The learner will need to ensure that all the necessary documentation/visual representation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of producing a characteristic selection matrix and provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application for managing the production of a characteristic selection matrix in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the production of a characteristic selection matrix
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 work with the customer to agree the customer requirements and manage the application of a characteristic selection matrix to the six sigma project 1.4 lead the production of a characteristic selection matrix for two of

the following:

a. concept
b. product
c. design
d. process
e. system
f. machine

1.5 lead the five-step process for generating a characteristic selection matrix:

a. list the customer key process output variable
b. score the key process output variables
c. list the key process input variables that impact the customer key process output variables
d. numerically rate the interaction between key process input variables and customer key process output variables
e. use ranking to prioritise future team focus

1.6 lead the collection of all the required data necessary to create the matrix

1.7 lead the production of a characteristic selection matrix for the chosen activity

1.8 use the characteristic selection matrix produced to agree scoring parameters for:

a. customers
b. team members

1.9 use the matrix produced to identify and approve activities in the process where improvements can be made

1.10 lead the preparation of and approve an action plan that will bring about the improvements

Learning outcome
The learner will: 2. know how to lead the production of a characteristic selection matrix
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the characteristic selection matrix activity 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 explain what is a characteristic selection matrix; why we need to produce them; who should create a characteristic selection matrix 2.4 explain how to generate a characteristic selection matrix using the five-step process 2.5 explain what is meant by the term 'customer' when producing a characteristic selection matrix 2.6 explain what are key process output variables and key process input variables 2.7 explain where in the quality function deployment matrix does the characteristic selection matrix appear 2.8 describe the inter-relationship between a characteristic selection matrix and a potential failure modes and effects analysis 2.9 describe the inter-relationship between six sigma process mapping and a characteristic selection matrix 2.10 explain how to score a characteristic selection matrix 2.11 explain how a process map links into a characteristic selection matrix 2.12 explain how a characteristic selection matrix links into a potential failure modes and effects analysis 2.13 explain how to utilise the results of a characteristic selection matrix 2.14 explain how to prioritise a six sigma project teams focus 2.15 describe the extent of their own authority within the project and whom they should report to, in the event of problems that they cannot resolve

Unit 513 Leading the carrying out of capability studies

UAN:	**L/600/5957**
Level:	4
Credit value:	14
GLH:	32
Relationship to NOS:	This unit has been derived from national occupational standard Business-Improvement Techniques Unit No. 29: Leading the carrying out of capability studies (Suite 4)
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit covers the skills and knowledge needed to prove the competences required for leading the carrying out of capability studies. It involves obtaining and approving all the necessary data needed to carry out the study analysis, and agreeing the appropriate sample size using statistical based techniques. From the study the learner will be required to lead the production of statistical information, this will include calculations for mean, mode, median, standard deviation, range, variance, and the capability indices Cp and Cpk for the process. The learner will also need to approve calculations for the sigma score (Z) from the Cpk and the parts per million outside upper and lower specification limits for the processes studied for both the long and short term. The learner will be expected to lead an analysis of the information gained and identify activities, which will improve the process capability. The learner will also need to lead the production of and approve a process capability report, highlighting the improvements to be made and the actions to be taken. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken and to report any problems with the

activities that they cannot solve or are outside their responsibility to the relevant authority. The learner will need to ensure that all the necessary documentation is completed accurately and legibly. The learner will be expected to take full responsibility for their own actions within the activity and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of capability studies, and will provide an informed approach to the techniques and procedures used. The learner will need to understand the principles and application for carrying out the capability studies, in adequate depth to provide a sound basis for carrying out the activities to the required criteria.

Applying and advising on safe working practices will be a key issue throughout.

Learning outcome
The learner will: 1. lead the carrying out of capability studies
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 lead the activities within their area of responsibility to include all of the following: a. set out an communicate the purpose of the improvement activities b. involve the team in planning how the improvement activity will be achieved c. ensure each team member has individual objectives and understands how these objectives contribute to the overall improvement objective d. provide advice and support the team to achieve both team and individual improvement objectives e. motivate the team to present their own improvement ideas f. encourage the team and/or individuals to take the lead where appropriate g. agree the implementation of the improvement ideas h. negotiate any physical and/or financial resources required to implement the improvement activity (where appropriate) i. monitor the progress of improvement activities j. deal with any organisational problems identified during the improvement activity 1.3 lead a capability study, which covers both: a. the short term b. the long term

1.4 obtain and approve all the necessary data needed to carry out the capability study analysis

1.5 agree the appropriate sample size using statistical based techniques

1.6 determine whether rational sub-grouping is appropriate

1.7 lead the process capability study and confirm relevant statistics

1.8 confirm the calculation of the following statistics:

a. mean
b. median
c. mode
d. standard deviation
e. range
f. variance

1.9 confirm the calculation of the following from the above statistics:

a. the capability indices Cp and Cpk for the process
b. the sigma score (Z) from the Cpk
c. the parts per million outside upper and lower specification limits for the processes studied

1.10 lead the production of a histogram to represent the cp and cpk graphically

1.11 obtain and approve the information gained and agree activities to improve the process capability

1.12 lead the production of and approve a process capability report highlighting the improvements to be made and the actions to be taken

Learning outcome
The learner will: 2. know how to lead the carrying out of capability studies
Assessment criteria
The learner can: 2.1 describe the health and safety requirements of the area in which they are leading the capability studies 2.2 explain how to plan the resources and time needed to carry out the agreed activity 2.3 explain why we need to assess process capability and how this affects a six sigma project 2.4 explain what is meant by the term sigma score (z) 2.5 explain how to calculate the sigma score (z) and use this to estimate the percentage outside of specification 2.6 explain what are cp and cpk and how are they calculated 2.7 explain how to calculate long-term capability from short term data 2.8 explain how many samples are needed for a statistically valid short term capability study 2.9 explain what is a population and what is a sample 2.10 explain how to select appropriate sample sizes 2.11 explain how to calculate parts per million 2.12 explain how to calculate mean, median, mode, standard deviation, range, and variance 2.13 explain how to perform rational sub-grouping 2.14 describe the extent of their own authority within the project and whom they should report to, in the event of problems that they cannot resolve

Appendix 1 Relationships to other qualifications

Links to other qualifications

Mapping is provided as guidance and suggests areas of commonality between the qualifications. It does not imply that candidates completing units in one qualification have automatically covered all of the content of another.

This qualification has connections to the:

- City & Guilds Level 2 NVQ Diploma in Performing Engineering Operations 7682-20
- City & Guilds Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering (1712-70)
- City & Guilds Level 3 NVQ Extended Diploma in Engineering Technical Support (1786-70)
- City & Guilds Level 3 NVQ Extended Diploma in Engineering Maintenance (1788-80)
- City & Guilds Level 3 NVQ Extended Diploma in Aeronautical Engineering (1789-34)
- City & Guilds Level 3 NVQ Extended Diploma in Fabrication and Welding Engineering (1789-70)

Example:

The Performing Engineering Operations (PEO) units within this qualification can also be achieved within the City & Guilds Level 2 NVQ Diploma in Performing Engineering Operations and the listed Extended Diploma's in Engineering. Prior achievement of these units can be used towards obtaining this qualification.

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see **www.cityandguilds.com/functionalskills**
- Essential Skills (Northern Ireland) – see **www.cityandguilds.com/essentialskillsni**
- Essential Skills Wales – see **www.cityandguilds.com/esw**

Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on **www.cityandguilds.com**.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- **Walled Garden**: how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for GOLA/e-volve assessments.

City & Guilds

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www.cityandguilds.com

Useful contacts

UK learners **General qualification information**	**T: +44 (0)844 543 0033** **E: learnersupport@cityandguilds.com**
International learners General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: **intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: **singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **walledgarden@cityandguilds.com**
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: **business@cityandguilds.com**
Publications Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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