Training Tomorrow's Engineers

Level 2 NVQ Diploma in Performing Engineering Operations (7682)

C&G Unit No: 206

QCF Credit Value: 15

Unit Title: Producing Mechanical Assemblies

Candidate	
Candidate No	

Table of Contents

Unit Assessment Plan & Feedback

Candidate		Group	

Unit & Assessment Plan
This unit will be undertaken by cross referencing evidence from unit 19 for two assessments and completion of the third assessment. Answering knowledge questions.

Summative Decision & Candidate Feedback

Assessor Name			
Assessor Signature		Date	

Candidate Name			
Candidate Signature		Date	

Unit Assessment & Verification Declaration

Candidate Declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work.			
Candidate Name			
Candidate Signature		Date	

Assessor Declaration: I confirm that this candidate has met the criteria of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. **Competence has also been proven in regard to pages 5, 10, 12, 19, observation assessment page 20, 21 and knowledge questions page 24.**			
Assessor Name			
Assessor Signature		Date	

Internal verifier declaration:
I have internally verified the assessment work on this unit by carrying out the following (please tick):

☐ sampling candidate and assessment evidence

☐ observation of assessment practice

☐ discussion with candidate

☐ other – please state:

I confirm that the candidate's sampled work meets the standards specified for this unit and may be presented for external verification and/or certification.

☐ Signed off by Internal Verifier for certification although not sampled

Internal Verifier Name			
Internal Verifier Signature		Date	

Witness Statement

I confirm the candidate carried out the required assessment which conformed to the requirements of the criteria.

Having met the requirement for the criteria for the remaining two assessments from Unit 019, the candidate has proven competent.

See declaration page 4

Awarding Body Standards

Replace this page with the awarding body standards

Assessment Criteria Index

		Performance Evidence 1	Performance Evidence 2	Performance Evidence 3	Additional Performance Evidence (if required)
	Evidence Type	***Written***	***Cross Referenced***	***Cross Referenced***	
	Date				
	ASSESSMENT CRITERIA				
1	**Worked safely at all times, complying with health and safety legislation, regulations and other relevant guidelines**	*Unit 06 Page 10*	*Unit 19 Page 19.1/2*	*Unit 19 Page 11.29a*	
2	**Carried out all of the following during the assembly activities:**				
	• Adhered to procedures or systems in place for risk assessment, COSHH, personal protective, equipment and other relevant safety regulations	*Page 20.1*	*Unit 19 Page 11*	*Unit 19 Page 11*	
	• Followed job instructions, assembly drawings and procedures	*Page 20.7*	*Unit 19 Page 11*	*Unit 19 Page 11*	
	• Ensured that all power tool cables, extension leads or air supply hoses were in a safe and serviceable condition	*Page 20.4*	*Unit 19 Page 11*	*Unit 19 Page 11*	
	• Checked that tools and measuring instruments to be used were within calibration date	*Page 20.4*	*Unit 19 Page 11*	*Unit 19 Page 11*	
	• Used lifting and slinging equipment in accordance with health and safety guidelines and procedures (where appropriate)			*Unit 19 Pages 41 + 36*	
	• Ensured that the components used were free from foreign objects, dirt or other contamination	*Page 20.6*	*Unit 19 Page 11*	*Unit 19 Page 11*	
	• Returned all tools and equipment to the correct locations on completion of the assembly	*Page 20.6*	*Unit 19 Page 11*	*Unit 19 Page 11*	
3	**Planned the assembly activities before they start them**	*Page 12*	*Unit 19 Page 13*	*Unit 19 Page 22*	
4	**Obtained and prepared the appropriate components, tools and equipment**	*Page 20.3*	*Unit 19 Page 11.f*	*Unit 19 Page 11.f*	
5	**Used the appropriate methods and techniques to assemble the components in their correct positions**	*Page 20.7*	*Unit 19 Page 41.12*	*Unit 19 Page 19.12*	
6	**Produced assemblies using six of the following methods and techniques:**				
	• assembling of components expansion/contraction				
	• fitting (such as filing, scraping, lapping or polishing)				
	• securing by using mechanical fasteners/threaded devices	*Page 19.1b*	*Unit 19 Page 19.14*	*Unit 19 Page 19.14*	
	• applying sealants/adhesives				
	• electrical bonding of components				
	• assembling of products by pressure				
	• setting and adjusting	*Page 19.3b*	*Unit 19 Page 41.17*		
	• drilling	*Page 19.6b*			
	• reaming				
	• balancing components	*Page 19.3b+c4*	*Unit 19 page 41.17*		

	• applying bolt locking methods		*Unit 19 page 41.17*		
	• shimming and packing		*Unit 19 page 41.13*		
	• blue-bedding of components				
	• aligning components		*Unit 19 page 41.17*		
	• riveting	*Page 19.6b*			
	• torque setting	*Page 19.3c*	*Unit 19 Page 19.14*	*Unit 19 Page 41.19*	
7	**Assembled products to meet the required specification, using nine of the following types of component:**				
	• assembly structure (framework, support, casings, panels)	*Page 20*			
	• pre-machined components				
	• fabricated components				
	• bearings		*Unit 19 Page 17*		
	• seals		*Unit 19 Page 17*		
	• bushes				
	• shafts		*Unit 19 page 17*		
	• chains				
	• couplings		*Unit 19 Page 41.17*		
	• sprockets				
	• cams and followers				
	• levers/linkages		*Unit 19 Page 17*		
	• keys		*Unit 19 Page 19.12*		
	• pulleys				
	• gears		*Unit 19 Page 41*		
	• Pipe work/hoses				
	• springs		*Unit 19 Page 17*		
	• belts				
	• gaskets		*Unit 19 Page 17*		
	• other (valves)		*Unit 19 Page 17*		
8	**Assembled products using two of the following assembly aids and equipment:**				
	• Work holding devices				
	• lifting and moving equipment		*Unit 19 Page 41 + 36*		
	• specialised assembly tools/equipment				
	• jigs and fixtures				
	• shims and packing		*Unit 19 Page 41.13*		
	• rollers or wedges				
	• supporting equipment				
9	**Secured the components using the specified connectors and securing devices**	*Page 20.7*	*Unit 19 Page 28.11*	*Unit 19 Page 41.17*	
10	**Secured the components using both of the following categories of fastening devices:**				
	• threaded fasteners (such as nuts, bolts, machine screws, cap screws)	*Page 20.9*	*Unit 19 Page 41.19*		
	• locking and retaining devices (such as tab washers, locking nuts, wire locks, special purpose	*Page 20.9*		*Unit 19 Page 38.14*	*Unit 19 Page 41.17*
	plus one more from the following:				

	• pins (such as parallel/dowels				
	• spring clips (such as external circlips				
	• rivets (such as countersunk	*Page 20.13*			
11	**Checked the completed assembly to ensure that all operations have been completed and that the finished assembly meets the required specification**	*Page 20.13*	*Unit 19 Page 41*	*Unit 19 Page 30*	
12	**Carried out the required quality checks, to include eight from the following, using appropriate equipment:**				
	• positional accuracy				
	• freedom of movement	*Page 20.11*		*Unit 19 Page 19.12*	
	• component security		*Unit 19 Page 41.19*		
	• completeness			*Unit 19 Page 29.20*	
	• dimensions				
	• orientation	*Page 20.7*			
	• alignment	*Page 20.11*	*Unit 19 Page 41.12*	*Unit 19 Page 12*	
	• function		*Unit 19 Page 19.15*		
	• bearing end float				
	• operating/working clearances		*Unit 19 Page 41.16*		
13	**Produced mechanical assemblies which complied with all of the following:**				
	• all components are correctly assembled and aligned in accordance with the specification	*Page 20.7*	*Unit 19 Page 41.20*		
	• moving parts are correctly adjusted and have appropriate clearances	*Page 20.10*	*Unit 19 Page 41.14*		
	• where appropriate, assemblies meet required geometric tolerances (such as square, straight, angles free from twists)	*Page 20.11*			
	• all fastenings have appropriate washers and are tightened to the required torque	*Page 20.9*	*Unit 19 Page 41.19*		
	• where appropriate, bolt locking methods are applied	*Page 20.9*	*Unit 19 Page 38.10*		
14	**Dealt promptly and effectively with problems within his/her control and sought help and guidance from the relevant people if he/she had problems that he/she couldn't resolve**	*Unit 19 page 11*	*Unit 5 Page 13*		
15	**Left the work area in a safe and tidy condition on completion of the assembly activities.**	*Page 20.16*	*Unit 19 Page 11.h*	*Unit 2 page 9*	

WITNESS STATEMENT

Candidate Name	

I confirm the candidate carried out the required assessment which conformed to the requirements of the criteria.

Having met the requirement for the criteria for the remaining two assessments from Unit 019, the candidate has proven competent.

1) Work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	
2) Plan the maintenance activities before you start them	
3) Obtain and prepare the appropriate components, tools and equipment	
4) Use the appropriate methods and techniques to assemble the components in their correct positions	
5) Secure the components using the specified connectors and securing devices	
6) Check the completed assembly to ensure that all operations have been completed and that the finished assembly meets the required specification	
7) Deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve	
8) Leave the work area in a safe and tidy condition on completion of the fitting activities	

Candidate has met criteria see declaration page 4.

Assessment

Overview

The learner is to produce a complete assembly of the Clarke Engine Stand. The learner is required to produce a fully assembled unit; fix an additional tool / drip tray and carry necessary checks.
Safe working practices must be carried out at all times. The learner must ensure all necessary documentation is complete.

Contents:

- Planning & Operation Sheet
- Risk Assessment
- Permit to Work
- Engine Stand Technical Information
- Assembly Drawing & Parts List
- Parts List Check Sheet
- Assembly Procedure / Inspection
- Observation Assessment
- Assessment Decision and Feedback
- Underpinning Knowledge

PLANNING & OPERATION SHEET - ASSESSMENT 1			
Name		**Date**	
Tools Required			**Materials Required**

WRITE DOWN HOW YOU CARRY OUT THE TASK AND THE ORDER EACH STEP WILL BE TAKEN			
1		**14**	
2		**15**	
3		**16**	
4		**17**	
5		**18**	
6		**19**	
7		**20**	
8		**21**	
9		**22**	
10		**23**	
11		**24**	
12		**25**	
13		**26**	

‘3-WHAT’S’ RISK ASSESSMENT

(to be completed by all trainees prior to ANY practical work)

Name : …… … Date: ……..

Area : ……..

Title or description of proposed activity:

WHAT CAN GO WRONG?

WHAT CAN CAUSE IT TO GO WRONG?

WHAT CAN I DO TO PREVENT IT FROM GOING WRONG?

I/we have read and understand the risk assessment(s) and will carry out the activity as safely as possible by following the recommended control measures.

Signed: ……. Date: …….

PERMIT TO WORK – Undertaken by:

WORK AREA / ROOM No: EQUIP. No.

DESCRIPTION OF TASK:

IS PROCESS OR ELECTRICAL ISOLATION NECESSARY YES / NO * (* delete as required)

(If YES, complete the rest of this section by ticking the applicable boxes)

	N/A	YES	NO
Is it necessary to break into any pipe or equipment ?			
Is the equipment positively isolated by spade or broken line ?			
Is the equipment only mechanically separated by valve or cock ?			
Is the equipment depressurised ?			
Is the equipment drained ?			
Is the equipment isolated from all sources of mechanical motive power ?			
Is the equipment electrically isolated ? If YES , state where isolated.			
Is any hot work being carried out?			

POSSIBLE HAZARDS:

P.P.E. TO BE WORN (tick where applicable & add any additional equipment in blank boxes)

Boots		Overalls		Safety glasses		Helmet	
Neoprene suit		Safety harness		Goggles		Gloves	
Leather apron (fabrication only)		Spats (fabrication only)		Full face protection		Dust / fume mask	
Ear protection							

LIST or ATTACH ANY RELEVANT PROCEDURE(S), / METHOD STATEMENT / RISK ASSESSMENT(S)

ADDITIONAL PRECAUTIONS:

IN AN EMERGENCY REPORT TO: Emergency Muster Point (road side grass verge / pavement front of buildings)

I understand the statements and do / do not* require to be shown the job (* delete as required).

Person handing over equipment	Person accepting above conditions of work	No. persons	Time / Date	Work signed back	Time / Date

NOTE : THIS PERMIT CAN ONLY BE RE-ISSUED ON CONCURRENT DATES IF CONDITIONS REMAIN UNCHANGED.

IS WORK AREA CLEAN AND SAFE YES / NO * IS THE TASK COMPLETE YES / NO *

(* Delete as required).

If NO, detail hazards remaining. .....

HAND-BACK ACCEPTED BY ..... TIME / DATE .....

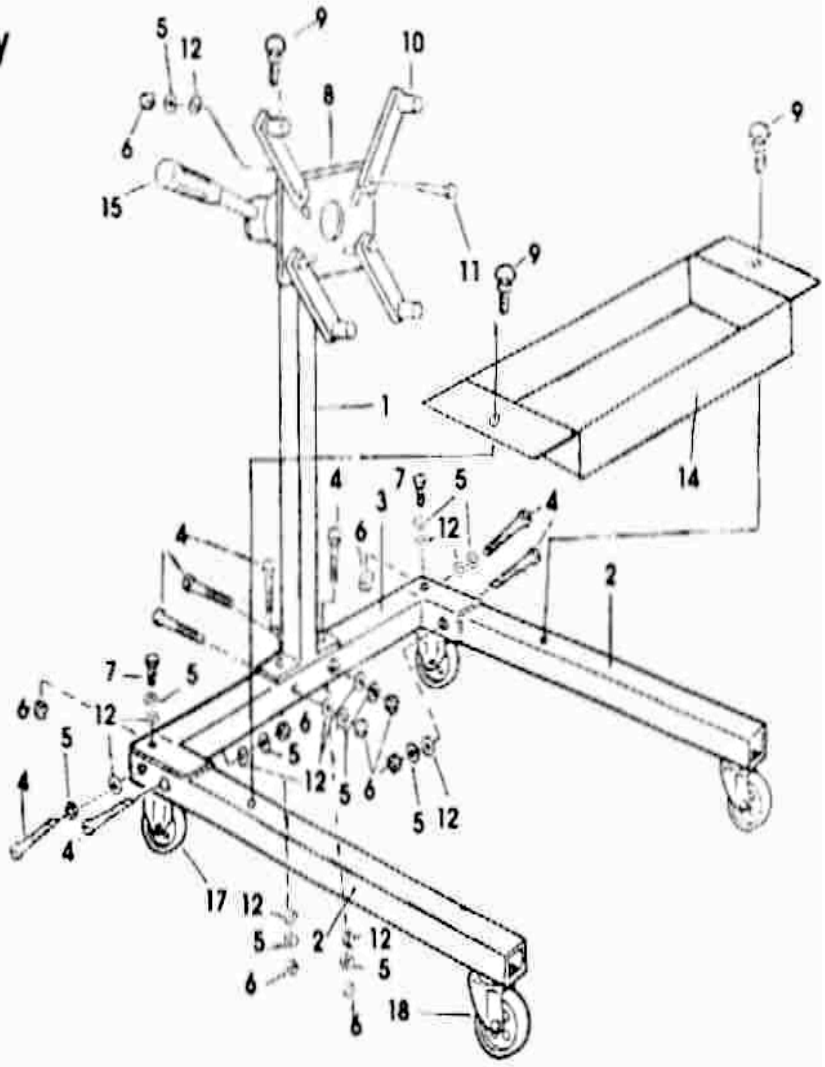
Engine Stand Technical Information- A3	
Maximum Capacity (Weight)	Up to 340 kg (750 lb)
Maximum Accessibility (for engines, cylinder heads and automatic transmissions)	360º
Stability (Extra – wide base)	4 Wheels
Extras	Detachable tool trays

Additional Personal Safety recommendations
• Always wear required PPE
• Check condition of all power leads, airline hose, etc., BEFORE use
• Maximum capacity (Weight) is 340kg (750 lb)
• Do not exceed the rated capacity
• Work only a flat, level surface, ensuring the load and stand are stable
• Lock mounting plate rotating mechanism BEFORE applying load
• Never work directly under a supported engine
• Do not use to transport engine or other load
• Ensure load is centred and secured to mounting plate

Assembly Drawing & Parts List - A3

Parts List

Part No.	Description	Qty
1-KH	Main Post	1
2-KH	Front Leg	2
3-KH	Side leg	1
4-KH	Bolt, 1/2" x 3 1/2" Lg	8
5-KH	Spring Washer, 1/2"	10
6-KH	Hex Nut, 1/2"	12
7-KH	Bolt, 1/2" 1" Lg	2
8-KH	Head Mounting Plate	1
9-KH	Lock Pin	3
10-KH	Mounting Arms	4
11-KH	Bolt, 1/2" x 2 1/2" Lg	4
12-KH	Washer, Flat 1/2"	14
14-KH	Tool Tray	1
15-KH	Rotation Handle	1
17-KH	Wheel, Rear 3 1/2"	2
18-KH	Caster, 3 1/2"	2



Parts List Check Sheet - A3

Before starting to assemble the engine stand, check that you have a complete set of components / parts by completing the check sheet

Part No	Description	Qty	Present Y/N	Qty
1 - KH	Main Post	1		
2 - KH	Front Leg	2		
3 - KH	Side Leg	1		
4 - KH	Bolt, ½" x 3½" long (Lg)	8		
5 - KH	Spring Washer, ½"	10		
6 - KH	Hex Nut, ½"	12		
7 - KH	Bolt, ½" x 1" Lg	2		
8 - KH	Head Mounting Plate	1		
9 - KH	Lock Pin	3		
10 - KH	Mounting Arms	4		
11 - KH	Bolt, ½" x 2½" Lg	4		
12 - KH	Flat Washer, ½"	14		
14 - KH	Tool Tray	1		
15 - KH	Rotation Handle	1		
17 - KH	Rear Wheel, 3½"	2		
18 - KH	Castor, 3½"	2		

As well as the main items there is also an additional tray to be fitted. You will need a set of appropriate spanners, adjustable torque wrench, Engineer's square and Rule, measuring tape, feeler gauges, sheet-metal cutting and forming tools, ' Pop ' rivets and riveting tool, plastic – headed ' soft ' mallet, Low - voltage drilling machine c/w transformer and extension lead and drill bit (to suit self – tapping screw sizes), self – tapping screws as available and suitable screwdriver. ◄

As with all workshop activities it is of the utmost importance that a safe working method is adopted from the very start of the job.

After reading the assembly instructions, a full risk assessment must be undertaken; considering not only your own safety but also the safety of others that may be affected by the activities. ◄

You then need to fill a method statement which will cover all the steps required to complete the operation including planning, health and safety, tools, and leaving the area clean and tidy on completion.

Assembly Procedure & Checklist - A3

(Note : All Dimensions are in Imperial units)

Step	Assembly Procedure Checklist	Candidate Check	Assessor Check
1(a)	Check all parts are free from damage, corrosion, etc.		
(b)	Assemble loosely the front legs (Item 2) to the side leg (Item 3) using four ½" x 3½" long (Lg) bolts (Item 4) four ½" spring washers (Item 5)four ½" flat washers (Item 12) and (Item 6) four ½" hex nuts		
2	Insert two ½" x 1" Lg bolts (Item 7) two ½" spring washers and two ½" flat washers into the hex nuts welded inside the front legs.		
3(a)	Secure the main post (Item 1) to the side leg using four ½" x 3½" Lg bolts; four ½" spring washers; four ½" flat washers and four ½" hex nuts.		
(b)	Check assembly for correct component orientation, squareness (using an Engineer's square), joint gaps in mating faces using (Feeler gauges) and any other alignments / movements.		
INTERMEDIATE INSPECTION REQUIRED BY TRAINING OFFICER			
(c)	Tighten all bolts fully to the correct torque value setting (Consult with chart for values).		
4	Slide the head mounting plate (Item 8) into the collar at the top of the main post. Align the holes and insert a lock pin (Item 9).		
5	Attach four mounting arms (Item 10) to the head mounting plate using four ½" x 2½" Lg bolts (Item 11);four ½" flat washers and four ½" hex nuts. The mounting arms are adjustable to suit various engine sizes.		
6(a)	Locate the tool tray (Item 14) into position with two lock pins.		
(b)	Using the manufactured / procured brackets as a template, Mark out and fix brackets to both trays(additional tool tray to Item 14), using felt tip Pen, Low – voltage (110v) drilling machine c/w transformer and extension lead and suitable drill bit (as supplied). 'Pop 'rivets and riveting tool, self – tapping screws and suitable screwdriver, Engineer's square and Rule.		
INSPECTION REQUIRED BY TRAINING OFFICER			
7	Insert the rotation handle (Item 15) through the hole at the end of the head mounting plate.		
8	The engine stand assembly is now complete and ready for inspection On completion of a satisfactory inspection, all relevant documentation must be completed.		
9	All tools to be stored away safely and securely and work area restored to safe, clean and tidy condition.		

Candidate	Signed	Date

Candidate proved competent see declaration page 4

Observation Assessment - 3	Observed by
Adhered to all H&S procedures, PPE, Risk Assessments & Permit to work	
Adhered to procedures and planned the assembly activity and obtained technical information	
Checked that all tools were in a safe and serviceable condition calibrated and in date	
Checked that power tool cables, extension leads were in a safe and serviceable condition and PAT tested	
Visually checked all components were present and record inventory	
Checked condition of all components were free from foreign objects, dirt, contamination, rust, damage,	
Assembled the engine stand in accordance with the Mfr's technical data and assembly procedure	
Torqued all fastenings to manufactures specification	
Ensured all bolt locking methods were in place (plain washers, spring washers, locking nuts, locking pin) to guarantee the assembly security	
Checked functionality for any excessive movement /free-play and made necessary adjustments	
Carried out quality checks – the : (a) correct orientation of all parts to each other (b) alignment of all angled faces and corners, etc. to each other (c) dimensions and squareness of the engine frame . Sound and well -established engineering techniques and practices were used throughout	
Additional tray fitted In accordance with the assembly procedure	
Checked accuracy, security and quality of riveting techniques , riveted brackets and screw fixings for the additional tool / drip tray,	
Returned any un-used materials and appropriately disposed of any waste	
Completed all documentation and returned to T.O	
Left working area in a clean, tidy safe condition and all tools and equipment returned	

I confirmed the T.O. explained the principles of the observation assessment to me and I agreed to this observation taking place.	
Candidate:	**Date:**
Signed:	

Candidate proved competent see declaration page 4

Assessor Feedback - A1
Candidate Feedback

Candidate proved competent see declaration page 4

Underpinning Knowledge

Candidate	

1)	Describe the health and safety requirements, and safe working practices and procedures required for the assembly activities undertaken
2)	Describe the importance of wearing appropriate protective clothing and equipment, and of keeping the work area safe and tidy
3)	Describe the hazards associated with the assembly activities (such as use of power tools, trailing leads or air hoses, damaged or badly maintained tools and equipment, lifting and handling heavy items), and how they can be minimised
4)	Describe the procedure for obtaining the required drawings, job instructions and other related specifications
5)	Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
6)	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerance
7)	Explain how to prepare the components in readiness for the assembly activities (such as visually checking for defects, cleaning the components, removing burrs and sharp edges)

8)	Describe the general principles of mechanical assembly, and the purpose and function of the components and materials used (including component identification systems such as codes and component orientation indicators)

9)	Describe the assembly/joining methods, techniques and procedures to be used, and the importance of adhering to these procedures
10)	Explain how the components are to be aligned, adjusted and positioned prior to securing, and the tools and equipment to be used for this
11)	Describe the various mechanical fastening devices that are used (such as nuts, bolts, machine screws, cap screws, clips, pins, locking and retaining devices)
12)	Describe the importance of using the specified components and joining devices for the assembly, and why they must not use substitutes
13)	Explain where appropriate, the application of sealants and adhesives within the assembly activities, and the precautions that must be taken when working with them
14)	Explain how to conduct any necessary checks to ensure the accuracy, position, security, function and completeness of the assembly (such as checking for correct operation where the assembly has moving parts, checking the torque figures to which critical fastenings have been tightened, checking the end float on shafts, checking operating clearance on actuating

	mechanisms)
15)	Explain how to detect assembly defects, and what to do to rectify them (such as ineffective joining techniques, foreign objects, component damage)
16)	Describe the methods and equipment used to transport, lift and handle components and assemblies
17)	Explain how to check that the tools and equipment to be used are correctly calibrated and are in a safe and serviceable condition
18)	Describe the importance of ensuring that all tools are used correctly and within their permitted operating range

Candidate proved competent see declaration page 4