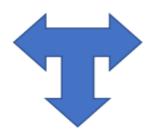


Course outline The course contains 3 elements

Engineering knowledge, understanding and skills (including practical skills) can and will be assessed throughout all 3 units. Many of the topics are covered in all 3 units, therefore, in each Learning Cycle you will be learning elements from all 3 units.

Unit 1: Manufacturing Engineering Products Controlled assessment: 20 hours 40% of gualification



Unit 2: Designing Engineering Products Controlled assessment: 10 hours 20% of qualification

Unit 3: Solving Engineering Problems Written examination: time of exam - 1 hour 30 minutes 40% of qualification

An assignment brief will be provided by WJEC for both Units 1 and 2 (basically they tell you what to make and design). Unit 1 must be completed before Unit 2, as they are linked.

Interpret engineering drawings

Designers and engineers use engineering drawings to convey information and details about the product to be manufactured or constructed.

Engineering drawings include details such as:

- · Sizes of parts or elements to be made
- Details on materials
- Information on finishes
- · Various views of the product
- Tolerances
- Scale
- · Details of complex parts.

Orthographic symbol -

Third angle projection

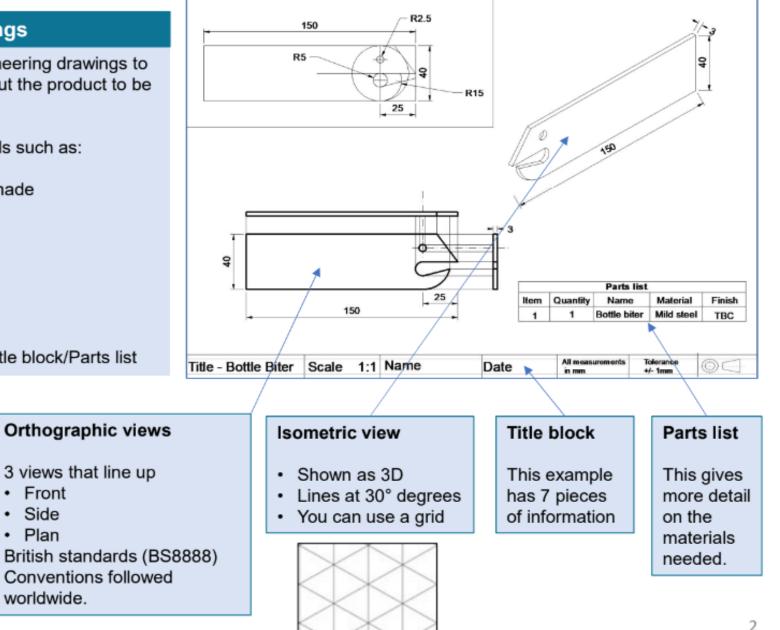
Most information will be in the Title block/Parts list

Front

Side

Plan

worldwide.



Planning manufacture

Before any manufacturing can take place, a plan is needed to determine each stage or step of the process.

The plan should include:

- · The materials to be used to produce the engineered product
- What equipment will need to be used
- What tools will be needed
- The sequence (order) that manufacturing needs to take place in.

The sequences need to consider in what order parts are manufactured, as some parts require others to be made to ensure they join correctly, etc. This is also known as **prioritising**.

Part	Material	Sizes (mm)	Quantity	Tools/equipment needed	H&S / PPE
Base	Smm Acrylic	150x 5 M4 (Countersunk)	1 (1 piece of acrylic)	2d design, Laser Cultar, Na, Saw, Countersinik Drill	Apron. Sefety Goggle
Upright Bar	12.5mm Stock Round Aluminium Ber	205 x 12.5 104 (Threaded)	2	Centre Lathe, Hacksaw, Tap	Apron, Selety Goggle
Top/Plate	Sowe Acrylic	58 x 30 x 5 -lines haise	1 (1 piece of acrylic)	3d design, Laser Culter, File	Apron, Safety Doggle
Hinge Bracket	2mm Sheet Aluminium	41.6 x 16 x 2 4mm holes	2	Hacksaw, Pilar Dilt, Folding Bar, File(s)	Apron, Safety Gaggle
Support Arm					Apron, Safety Gapple
	vamnio	NT 3 I			
	xample		-		Apron.
	ometime		-		Apron. Apron.
	•		-		Apran,
Central Loca Shade	ometime	s call		b sheet.	Apran,
Central Lock S Shade	ometime	50x 40x 10 50x 40x 10 20x 8x 10 1M1 (Threaded)	ed a Jo	b sheet.	Apron, Apron, Safety Goggle
Central Loos S Shade Bolt Wing Nat	ometime	50x 40x 10 20x 8x 10 20x 8x 10 M4 (Threaded) M4 x 0.7 x 25		b sheet.	Apron, Apron, Safety Goggle
Central Loos Shade Bolt Wing Nut Button Head Cap Son	ometime	50 x 40 x 10 20 x 8 x 10 NM (7/maded) NM x 0.7 x 25 NM		b sheet.	Apron, Apron, Salety Goggle Apron
Central Loca	ometime	50 x 40 x 10 20 x 40 x 10 20 x 8 x 10 M4 (Dreaded) M4 x 0.7 x 25 N4	ed a Jo	b sheet. Solvert Dament Bought In Component Dought In Component Bought In Component	Apron, Salety Goggle Apron Apron
Central Loos Shade Bolt Wing Nut Button Head Cap Son Button Head Cap Son Countersum Head	ometime	S Call	ed a Jo	b sheet. Solver Danert Bought In Component Dought In Component Bought In Component Bought In Component Bought In Component	Apron, Salety Goggle Apron Apron Apron Apron

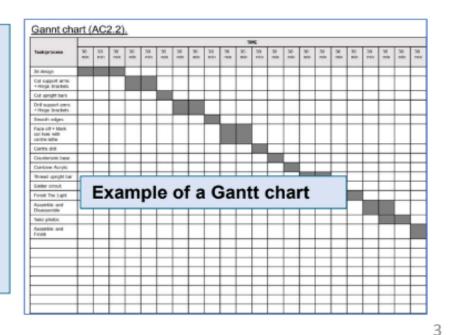
Part	Material	Task including toots/equipment	Quality control checks	
8210	Acrylic	Cut Out Shepe - 20 Design, Laser Outer 150mm	Ensure correct-dimension and recessariaments.	
		File The Edges - File, Wet and Dry	litate sure there's no rough origon	
		Countersite Drilling - Countersite Drill M4 screw	Con't go all the way through	
Top Plate	Acrylic	Out Out Shape- 20 Design, Laser Outer	Ensure correct dimension and measurements.	
		File The Erdges - File, Wet and Dry	lifelie sure there's no rough edges	
Counter Weight	Acole	Cut Out Shape - 20 Design Laser Cutler	Ensure correct-dimension and measurements.	
E	Exampl	e of a Production p	lan te surput	
E	Exampl	e of a Production p		
	Exampl	•	lan *******	
	· ·	anour coger-rie; means ory	Ian Part the screws fit	
Central LockPivat	· ·	Oncourrouger="responsion org	Ian native screws ft	
Central LockPivat	Actylic	Carbox Dage - The Weined Dry Cut Dut Shape - 2D Design, Laser Outor Combine 2 Parts - 2 ¹⁴ Layer of Actylic, Solvent Cement	Ian Rat the some till Rat the some till Return constitution and Brown constitution and researchments. Univ or perfectly Ensure constitution and	
Central Lock/Fivet	Actylic	Carbox Coger - recrementatory Carbox Shape - 20 Design, Laser Cutter Combine 2 Parts - 2 rd Layer of Acrylic, Solvert Cement Carbox Shape - 20 Design, Laser Cutter	tan be some to be an example of the some to b	
Central LockPivat	Actylic	Candon Cager - I ner Weiters Coty Cut Out Shape - 20 Design, Laser Outer Combine 2 Parts - 2 rd Layer of Actyle, Solvert Demant Cut Out Shape - 20 Design, Laser Cutter Candone At The Parts - Solvert Centert	Lan Rat the some fit	

Contingency planning

Planning should also include ways to overcome any unforeseen problems.

Examples:

- Illness
- Broken machines
- Others using machines
- Material not available



Understanding the physical properties of materials

Understanding that materials can be defined by a range of properties, for example:

- Tensile strength the ability of a material to resist stretching or breaking when pulled
- Compressive strength a materials ability to withstand loads without changing its shape
- Hardness this is a materials ability to resist changing shape when impacted by another object
- Toughness the ability of a material to absorb energy (impacts) before it starts to deform (change shape)
- Malleability the materials ability to be repeatedly hammered, pressed, bent or rolled into thin sheets
- Ductility the ability of a material to be drawn or plastically deformed without breaking
- Conductivity a measure of how well the material conducts heat or electricity
- Corrosive resistance how well the material can withstand damage caused by chemicals or oxidisation
- Elasticity the ability of a material to limit distorting and return to its original shape and size
- Environmental degradation how the physical environment is degraded, damaged or compromised through a range of situations such as air pollution, water contamination etc.

Know the names and the definitions

Understanding materials, their properties, and their selections for specific purposes

Properties and classifications of materials

Ferrous metals contain iron and are magnetic. They are also prone to rust and need a protective finish to prevent corrosion.

Cast iron is brittle if thin, can be cast in a mould, has strong compressive strength, good electrical and thermal conductivity, but has poor resistance to corrosion. It is used for products such as gates, manhole covers and drains.

High carbon steel is also known as **tool steel**. It is hard and brittle and is less malleable than mild steel. It is an effective electrical and thermal conductor. Uses include tools, screwdrivers, and chisels.

Low carbon steel is also known as mild steel and is ductile and tough, easy to shape, braze and weld. It is a good conductor of heat and electricity, but also corrodes easily. Commonly used for nuts and bolts, screws, bicycle frames and car parts.

There are many others.

4

Understanding materials, their properties, and their selections for specific purposes

Properties and classifications of materials

Non-ferrous metals do not contain iron and are not magnetic. They do not rust.

Aluminium is lightweight, malleable and strong. It is a good conductor of heat and electricity. It is used in drinks cans, cycle frames and saucepans.

Copper is very malleable and an excellent conductor of electricity and heat, which makes it perfect for plumbing and central heating applications. It is orange/brown when polished but will oxidise to a green colour.

There are many others.

How environmental issues affect engineering

How engineering applications and products have an environmental impact

Raw materials – how the landscape is affected? Transport and pollution? Cost of materials and production?

Recycling – all metals can and should be recycled. What affect does this have?

Understanding materials, their properties, and their selections for specific purposes

Properties and classifications of materials

Alloys - A mixture of two or more elements with the major part a metal.

They can be **Ferrous or Non-Ferrous** metals. Alloys were developed to **improve the properties** of existing metals. By heating, melting and mixing the elements, you can create new metals with new, different properties.

Brass a non-ferrous alloy 65% copper, 35% zinc. Easily cast into shapes and corrosion resistant. Hard, good conductor of heat and electricity. Used for handles, musical instruments and padlocks.

Stainless steel a ferrous alloy. Mainly iron with chromium and nickel (plus some others). Hard, tough, corrosion resistant, high tensile strength. Used for cutlery, saucepans and medical equipment.

Duralumin a non-ferrous aluminium based alloy. Lightweight and corrosion resistant. Other properties - hard, ductile, malleable, high strength to weight ratio. Used in the aircraft and car industries.

There are many others.

5

WJEC Level 1-2 Vocational Award in Engineering (Technical Award): Learning Cycle 1

5

Implementing engineering processes

The physical making of a product (or part of) using a range of processes. PPE must be worn.

Marking out

- Engineers blue
- Scriber
- Steel rule
- Engineers square
- Dividers (straight calipers)
- Calipers internal, external and odd leg
- Centre punch
- Ball pein hammer

Cutting/shaping

- Metal vice
- Hacksaw
- Junior hacksaw
- Files
- Pillar drill
- Drill bit
- · Machine vice
- · Cold chisel
- Reamer
- Deburring tool
- Emery cloth

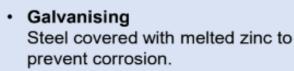
Finishing

- Oven
- Gas hearth

Implementing engineering processes

Finishing is applied at the end stage of production. Ferrous metals need a finish to prevent corrosion. A range of **METAL** finishes are below:

 Plastic dip coating Mainly used on steel, heated metal covered in plastic power.



Anodising

Best used on aluminium, an industrial process using acid, electricity and dyes.

- Powder coating Like Plastic Dip Coating but the plastic powder is sprayed on.
- Blueing
 Steel is heated up and dipped in oil.
- Painting Painting metal creates a protective barrier to prevent corrosion.
- Enamelling Enamelling involves melting powdered glass onto a metallic surface.













Health and safety

Assessing potential risks is a process that is undertaken prior starting manufacture. It should identify what potential hazards and risks may be present. This should include both the working environment and the actual items of equipment to be used.

Deciding on control measures should focus on stating how the identified risks and hazards can be mitigated (made safe). This should include detailing about guards on equipment and specific any hazards around the working environment.

Personal protective equipment should also be identified for manufacturing stages and should only include appropriate choices suitable for the individual task being undertaken.

Sign	Meaning	Shape	Colour	
	Mandatory: Specific instruction on	Round	White border, blue background, white pictogram	
	behaviour			Signs
Δ	Warning sign:	Triangular	Black border, yellow/orange background, black	and
	Giving warning of hazards or danger		pictogram	symbols
	Prohibition sign:	Round	Red border, white background, black	
\bigotimes	Prohibiting behaviour and/or actions		pictogram	
	No danger:	Square or rectangular	White border, green background, white	
First aid	Information on first aid, emergency exits, emergency stop, etc		pictogram	

			-	
1.075 Man Rega	POR	WODD WORKONG: ITABLE POWER TOOLS - DRILLS DRILLS		
Procession	coverest?	The deling of holes in workplaces has large to bring to fixed machines.		
		Mostportable power trails are seeking symptot but presential to be an used where sergeneousline is available. The use of back with Hilling's toxic solidge ballow parks in increasing	£	
HAZARDI	5			
Flying mate	hial	Of case, check ways or feeders bits can be ejected violently. If machines are used with accessories or adaption, the accessory car become indealed from the machine assuring parts in Second		
User injury				
Tripping	Power leads or air powe prevent a hipping hazard and may be damaged, preve electrical an exerption of integents.		8	
Enlangtement Long hat, tanging powing or toose defining seriescores enlargied with parts, daugeling the user units them.		Long bait, therefing provides or increase-chefting run increases entangled with relating parts, daugging the user unit them.		
		Haday mantpraces and the generative field of infalling maters can preserved manual-tending fraction.		
Ourse		Drift falls can became fuit.		
RISK ASS	ESSMER	NT .		
Flying mate	hint	Figing of cuts are selfedly to accur but Terra is a high risk that insequenced users will tread shift or not assemble multi-function costone-correctly.		
User injury		There is a high-risk that balance will got handle at fingers in house story planes and respective set was may altergial short sale. Where a full jurns, some sames may not b after to reached the foco.	•	
Tripping		Trailing waste or pipes present a roak risk of tripping and carriage.		
Entengiere	ent .	Examplement is most likely to soour throading parts are expressed.		
Manual har	dileg	Handling leasely components or avovend manipulation will not accur hespentity (out will present a teal fait. Newtons may have difficulty controlling the text.		
Burns		Burse from machines and chades are assaily superficial.		
CONTROL	L MEASU	JRES	٦	
		It is improvidential to guard all the hocardows areas when our globalite power tool Correct extension of the Strapent will reduce the table of diff breakage.	۱.	
		Eye protection is needed.		
		Quality among balance parts were duce the match frame or frequency and experience are assessible in reducing data. Highlar powered balance parented datas are used considerable langue.	1	
		The route of power leads and pipes should be chears to restress trigging and decruge flattery-powered tools avoid this protion.		
		Long hair mention field back loweritry should be removed or sovered and local statistic common by a second agree or evenal.		
		The date of black legacy is reduced if has persons leavelin heavy leave.		
		Given as plans sould be used to handle any items that night he had.		

Risk assessment: Five-step method

Step 1. Identify the hazard (what could happen)
Step 2. Who may be harmed and why?
Step 3. Evaluate the risk and choose precautionary control measures (how will you reduce the risk)
Step 4. Record (write down) your findings
Step 5. Review and update when needed



Heard	Who will be harm and why	y? Risk level-HML	Control measure
	Create your own risk assessments		
	Reason		
	Role		