GETTING STARTED

Working with a partner, think about the reasons why some products need to be redesigned.

Ways to improve the solution

There are many reasons why a product or component might need to be redesigned. For example, it may need to be redesigned so that it still fits another component that has also had to be redesigned, or the manufacturer might have considered that the processes used are not environmentally friendly.

Evaluating an existing design

Designers will normally be given the reasons why a product needs to be redesigned, or why the features need to be improved to make the product more effective at meeting its design requirements.

ACTIVITY

You have been asked to redesign a batch-produced shelf bracket. The manufacturer of the bracket has had complaints from customers that the bracket bends and cannot hold the loads it is designed to support.

The existing bracket is made from aluminium and is shown in the image below.

1 Use the internet to find out information about the materials and processes that are used to make the existing bracket.

2 Evaluate the existing bracket design to identify issues that could be causing it to fail and not meet the design brief.

The evaluation of an existing design will need to bring together information about various factors and review it to form a conclusion, drawing on evidence from the design brief and engineering drawings; it should include the strengths and weaknesses of the existing design.

When evaluating an existing design, you need to do the following tasks.

- Read through the original design brief for the product.
- Highlight the key points that the design must meet.
- Look at the existing design and circle features that you think could be an issue – this will ensure that you do not forget anything when you are writing your evaluation.
- Consider using subheadings in your evaluation, one for each product feature, and give reasons why you think the feature is going to be a problem. Try to include some information about each of the following factors in your evaluation:
    - physical requirements
    - aesthetics
    - size
    - function
    - performance requirements.

Remember that you need to justify your reasons and use connectives – for example: 'The bracket might not support the weight of the shelf because the material is very thin.'

LINK IT UP

In Component 1: Learning aim B, and earlier in this component, you looked at engineering design briefs. Use your understanding of the various factors included in a design brief to help you evaluate an engineered product.

Your evaluation will help you to decide which features of the product need to be redesigned and how to plan for the production of an improved design. This process should give you an opportunity to identify limitations and constraints associated with the existing design.

- Limitations are factors that impact on how well the design functions – for example, the maximum weight that could be supported by a bracket or the number of fixings needed to keep something secure.
- Constraints include things such as materials, costs, space available for the product or other parts that it must fit together with. A USB connection lead would be useless if the plug was a different size and shape from the port it needed to plug into – for the connection to work, the lead and the plug must fit together (this is an example of a constraint).

CHECK MY LEARNING

You have learned about some of the issues to be considered when evaluating an existing engineering solution to a problem.

With a partner, look at a product that you use as part of your daily life – for example, a watch, a mobile phone or even an item of clothing – and identify the strengths and weaknesses of the product's design.

Producing an alternative design solution

GETTING STARTED

Working with a partner, think about ways in which an engineered product you have evaluated previously could be redesigned to make it more effective.

You will need to use your evaluation of an existing product to develop an alternative design solution that meets the requirements of the design brief. It is a good idea to think about different approaches before starting to sketch out designs on paper.

We have already looked at methods that can be used to redesign a product or component, but some of these approaches are not always suitable. In the case of a support bracket, like the one in the previous lesson, we cannot simplify the design by reducing the number of components because it has only one component to begin with.

ACTIVITY

Look at an existing engineered product that you have evaluated previously and think about the following:

1 How could the performance of the product be improved?
2 What could be changed to make the design more effective?
3 Can the materials be changed?
4 What alternative processes could be used?

When producing an alternative design solution, you will need to answer these types of question and think about how you could include all these factors in a design solution.

You need to produce design ideas that:

- meet the design brief in full
- show an improvement on the original design
- include justifications of the alternative design solution – this will link to your evaluation
- include justifications of the processes to be used in manufacturing.

Remember that if you are asked to produce one design idea only, you need to ensure that your idea meets all the requirements of the design brief and addresses all areas of improvement that you have proposed in your evaluation.

It is important that you annotate your design work clearly to ensure that other people can understand what you mean and the design features intended.

Justification of your solution

It is normal for the **justification** of the proposed solution to be presented in a written report, so you need to ensure that points are made clearly and linked to both the design brief and your evaluation of the existing design.

KEY TERM

Justification is the reason or evidence to support an idea or design.

You will need to choose a solution based on the advantages and disadvantages of each design idea. As we have seen before, this could be done by checking how much of the design brief is met by each of the ideas and how much of a variation from the original design your new proposal would involve. Make sure you show links between the disadvantages of the existing design and the advantages of your improved new design. Remember to support your comments with reasons.

You could use a best-fit approach to select the best solution. This is similar to the RAG rating that we looked at earlier. You will need to consider the strengths and weaknesses of each of your design ideas and compare them against the design brief.

Some aspects of a design brief are more important than others, so you should identify a solution that meets all the criteria satisfactorily.

Your solution should show that you have a good understanding of engineering theory and processes.

When you are generating initial ideas, think about any limitations or constraints associated with the design. Does the design solution have to fit in a certain space or does it need to be a particular colour? You must be sure that your improved design meets all the constraints that are given.

As a further example of a constraint, suppose that the shelf bracket previously mentioned must have three holes to attach it to a wall, and these must be in the same location as the existing holes.

Finally, you should also identify the limitations of your design; for example, if you plan to make the product from medium carbon steel, then a protective coating will be needed, otherwise it will corrode.

CHECK MY LEARNING

You have learned about some of the factors that need to be considered when justifying a design solution. With a partner, discuss the following questions:

1 How can you check if a design meets the brief?

2 Why is material choice important?

3 How can you support the decisions that you make?

Reflecting on your design solution

GETTING STARTED

Look at the shelf bracket we have been investigating and redesigning. Make a list of the reasons why you think the manufacturer selected the materials and manufacturing processes used in the original bracket design.

We have looked at some of the things that you need to consider when justifying your design solution, including the reasons for your choice of design idea. You also need to justify the approach you propose to take for manufacturing the new design.

When selecting materials for the redesigned product, there are a number of factors that you should think about:

- material properties
- material cost and availability
- the processes that you plan to use
- the environment.

Material properties

There will be an expected level of performance from the material selected so that it will do the job it is designed to do. This could be related to the mechanical properties of the material, such as strength or durability. If the material properties are not suitable for the purpose, then the product or component will fail.

LINK IT UP

Go to Component 2: Learning aim A for information on material properties.

Material cost and availability

The cost of materials that you plan to use must be appropriate for the product. While materials such as titanium might offer improved properties compared to mild steel, if, for example, the application is a coat hook, then the cost of titanium is probably too high.

Materials must also be readily available; there is little point in specifying a material that cannot be easily obtained.

Processes to be used

Selection of materials must be linked with how you intend to manufacture the product; for example, which cutting, shaping, forming, and joining and fabrication techniques are you considering? The material choices must be suitable for the processes you plan to use.

LINK IT UP

You have investigated a range of cutting, shaping, forming, and joining and fabrication techniques in Component 2: Learning aim A.

The environment

You need to think about where the product is to be used and the effect that the environment will have on the product; for example, a shelf made from polymer materials would not be suitable for use inside an industrial oven.

Conversely, you also need to think about the effect that the materials and the manufacturing processes used will have on the environment. Casting, for example, uses a lot of energy to heat the materials. However, very little waste is produced during the casting process. You will need to weigh the advantages and disadvantages of using a particular material against the environmental impacts.

Another environmental factor to consider is whether it is possible to reuse or recycle waste produced either during the manufacturing process or at the end of the life of the product.

Making recommendations for improvements to the best solution

Your selection of the best manufacturing process to use is also important because it needs to be suitable for the product you are designing. You will need to make recommendations for improvements to allow the best solution to be produced.

Consider the advantages and disadvantages of alternative processes; for example, a coat hook could be cast in aluminium, or it could be formed by cutting and then bending strips of aluminium. The process chosen will need to take into account the scale of production, such as whether the component needs to be made in a batch, and the complexity of the design. The most important thing to remember is that you must always be able to justify your decisions.

ACTIVITY

Review your chosen design solution for an improved engineered product.

1 Justify your choices of materials.

2 Justify your choices of manufacturing processes.

Make sure that you link your justifications to the improvements you have suggested for the design as well as the original design brief for the product.

CHECK MY LEARNING

You have investigated some of the factors that need to be considered when making decisions about the materials and manufacturing processes to be used to improve an engineered product.

With a partner, discuss the following questions:

1 Why are the properties of a material important when making decisions about its use?

2 Why does the environment need to be considered when choosing and justifying a design solution?

3 What factors can influence the choice of processes?

Resources required and their use

GETTING STARTED

Working in a small group, examine a piece of equipment in your classroom or workshop. Write down all the types of resource that you think would be required in the manufacture of this equipment.

Having selected your design solution, you then need to think about specific details of the solution, especially the resources required to produce the product. These resources include the materials, tools and tooling, components, equipment and apparatus needed.

Materials

It is not only the type of material that is important, but also the form of supply, the sizes needed and any surface finishes or textures that will be required. Materials can be supplied in a range of forms, depending on the material category, as shown in Table 3.19.

Table 3.19: Material forms of supply

Metals	Polymers and composites
Ingots	Powders
Castings	Pellets
Forgings	Extrusions
Pressings	Mouldings
Bars or rods	Sheets
Sheets	Resin
Plate	Films
Pipe or tube	Pipe or tube
Wire	
Rolled sections	
Extrusions	

Tools and tooling

The types and forms of selected materials will affect the tools and tooling that need to be used. For example, if polymers are selected for the product, and they are to be supplied in pellet form, then the manufacturing processes that can be used will be limited, with injection moulding being the most likely choice.

In reality, decisions about materials, their forms of supply and manufacturing processes will be made jointly as each decision impacts on the others. The decision about the most suitable methods for manufacturing a component will take into account the features that need to be produced; this in turn will have implications for tooling. If die casting is suggested, then a die will need to be produced and metal heated until it melts and can be poured. If a turning process is suggested, then a lathe will be needed, along with appropriate cutting tools depending on the type of metal being turned and the features to be produced (see Figure 3.28).

The choice of tools and tooling also needs to be suitable for the scale of production expected.

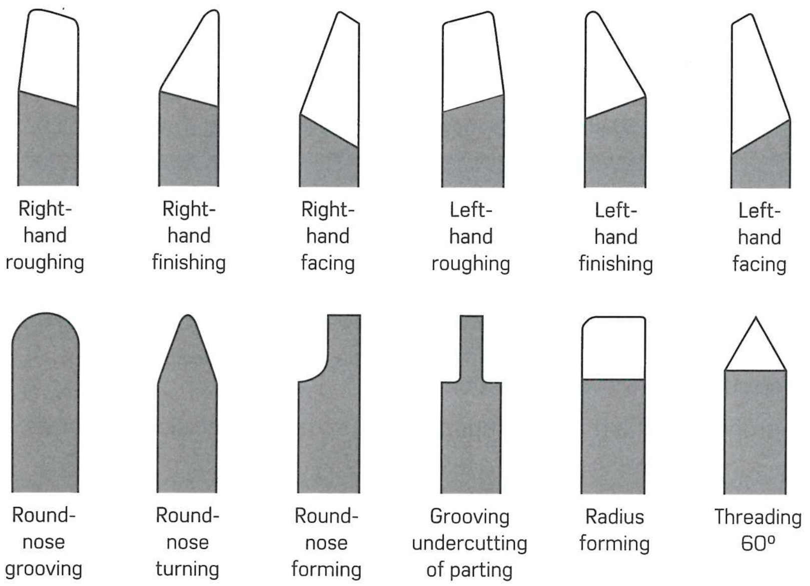


Figure 3.28: Lathe tools should be selected depending on the feature to be produced

Components

Components have been considered at a number of stages in the design process. However, when deciding on the components to be used for a redesigned or improved solution, the choices may not be that simple.

You need to ensure that, if necessary, any alternative components are compatible with the existing design. This is especially important if the new component is a replacement for an existing, different component. It may still be possible to standardise on the type of component – for example, using the same type of screw head or standard dimensions and values of electronic components.

Equipment and apparatus

Sometimes there will be a need to use specialist equipment or apparatus when producing a redesigned product or component. It might be that specific instruments will need to be used to check the surface finish of a component, or sensors will need to be used to check if an electronic circuit has the required levels of sensitivity.

The equipment resources to be considered might include work-holding devices such as machine clamps to hold workpieces in place when they are being milled or drilled; soldering irons and related hand tools for soldering activities; or measuring equipment to ensure that components fit together as specified.

ACTIVITY

You have been asked to plan the manufacture of an engineered component that has features that need to be produced by either milling or turning.

1 Carry out some research into the tools and equipment that will be needed, and list these.

2 Write a short report to explain and justify your choices of resources.

Example

To manufacture a redesigned shelf bracket, mild steel could be chosen as the material and shearing, drilling and bending processes used to shape it. Specifying a standardised drill size (e.g. 8 mm) allows standard components to be used, and using a jig ensures that all brackets will be bent to the correct angle.

CHECK MY LEARNING

You have learned about the resources that you are likely to need when manufacturing an engineered product. With a partner, make a list of the following types of resources for the manufacture of an engineered product you are familiar with:

- materials
- tools and tooling
- components
- equipment and apparatus.

Presenting your solution

GETTING STARTED

Make a list of the different 2D and 3D presentation techniques that can be used to communicate a design solution.

In addition to justifying a design solution and the processes and materials that you plan to use, it is important to consider the methods that can be used to present the solution.

When selecting presentation methods, you will need to consider a range of techniques and decide which will be the most appropriate. These can include both sketching and formal presentation drawings. We have looked at each of these in detail earlier in this component.

Drawings

An isometric drawing, as in Figure 3.29, allows the features of a design to be shown in three dimensions so that another engineer or a potential user can visualise what it will look like in real life.

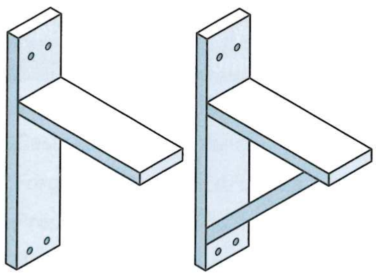


Figure 3.29: Isometric drawing of a redesigned shelf bracket

One of the limitations of isometric drawings is that they do not always provide enough information for someone to produce a product or component directly from them. Often, you will need to use another drawing or document to provide the full information.

If the idea you have produced is complicated, it might be better to use an isometric drawing to show the overall shape and form of the design proposal and also use orthographic projections to show details of the design features.

An orthographic drawing, as in Figure 3.30, allows construction details to be added, such as dimensions, both linear and angular, and notes about surface finishes and joining methods.

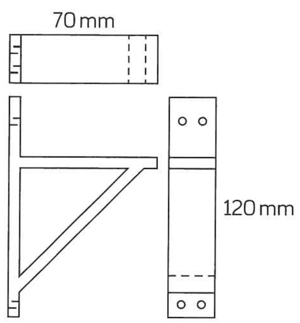


Figure 3.30: Orthographic drawing of a redesigned shelf bracket

Remember that when producing an orthographic drawing, you need to ensure that details are absolutely clear.

You will also need to use the correct line types for hidden details, outlines, centrelines and dimensions. Don't forget that you should always show dimensions in millimetres (mm).

Also think about the scale of the drawing. If the product or component is small, then it may be better to produce a drawing to a larger scale, one which shows the item at a larger size than in real life.

ACTIVITY

Previously, you made sketches of a redesigned shelf bracket. Now produce the following two drawings of your solution:

1 an accurate isometric drawing

2 an orthographic drawing.

Remember to add annotations and dimensions to your drawings to explain the features of the design.

LINK IT UP

You have investigated the use of CAD software to produce drawings in Component 1: Learning aim B.

Think about the methods used to present 3D CAD models, and try applying these same approaches in your presentation of ideas.

Annotations

Annotations are very important in design work. You must ensure that you add appropriate annotations to design information so that they clearly explain:

- the features of your solution and how it meets the design brief
- the materials and processes that you would use, including the reasons why
- details of how the solution will work; for example, if there are any moving parts, then explain how these will operate.

CHECK MY LEARNING

You have practised different methods of presenting an engineering design using different kinds of drawing.

Working with a partner, look at ways in which your drawings could be improved. Some starting points you could think about are:

- accuracy
- the amount of detail included
- size and scale.

Make processes to create a prototype solution

GETTING STARTED

With a partner, make a list of the advantages and disadvantages of producing prototype models when developing a new product.

LINK IT UP

In Component 2, you looked at the making skills associated with the production of a product.

When developing a new product, there are a number of reasons for making a prototype, including:

- trialling ideas to see if they work as expected
- testing a product to check that it functions as intended
- gaining a better understanding of the problem.

There are different ways of producing a prototype, including the use of rapid prototyping and traditional physical modelling.

Processes to follow and use

You will need to think about processes in relation to using tools and equipment, health and safety, and manufacturing processes like casting, forging, welding and the use of jigs and tools.

3D printing – additive manufacture (AM)

You could create a CAD drawing of a component and then send this to a 3D printer to be manufactured. This enables an accurate model of the design to be produced, which can then be used to test whether or not the design would work. It is even possible to produce 3D printed models with parts that move.

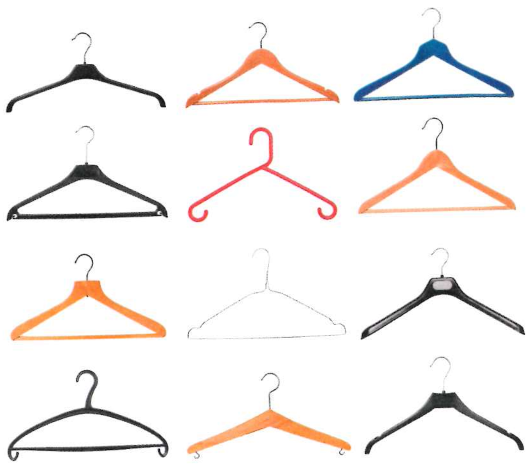
You should experiment with and practise producing accurate CAD drawings of engineered components. If a 3D printer is available, use simulation software to view the models onscreen and then manufacture the component.

Physical modelling

A physical model can be made using a range of modelling materials. These include card, wood, plastics and parts reclaimed from disassembled products.

As already considered in Component 1: Learning aim B, 3D models may be viable if they are made by hand. Prototype models can be made easily from materials that are easy to shape and easy to modify.

In some cases, you can produce a model that incorporates 3D printed parts, with other aspects of the design made using traditional physical modelling methods.



Different materials can be used to produce models for the same solution

If prototypes for the same design are made from different materials, it can help with the selection of material forms and manufacturing techniques.

ACTIVITY

Make a small model of the design for a shelf bracket that you developed in previous lessons, using either 3D printing or physical modelling.

If you do this by physical modelling, use materials that are easy to work with, such as cardboard, and then check that the model fits the physical dimensions required for the shelf bracket.

Following correct processes

Whenever you are modelling or carrying out any part of an engineering investigation, you should follow the correct processes. Think about manufacturing on a larger scale and for the actual product. This could involve casting, forging and welding, along with the use of other tools and jigs. You may need to research how certain processes are carried out and whether they are suitable for your design.

It is especially important to follow correct procedures when using tools and equipment. You should only ever use tools and equipment that you have been given permission to use and shown how to use safely. The engineering saying, 'If in doubt – ask!' applies to all parts of an engineering activity: if you are not sure how to do something, then ask for help.

Also ensure that you work safely at all times and follow the health and safety rules for the equipment you are using. Remember to follow instructions and use the correct PPE to carry out each process.

CHECK MY LEARNING

You have learned about the processes that can be used to produce both prototypes and final products.

With a partner, thinking about the model you made in the previous activity, answer the following questions:

1 What are the advantages and disadvantages of additive manufacturing?

2 What are the advantages and disadvantages of physical modelling?

Then discuss which method would be best for prototyping two vastly different design solutions, such as a bridge structure and a small clamp.

Collecting and analysing data

GETTING STARTED

With a partner, make a list of the types of data that could be collected from engineered products. Discuss which of these types of data can be used to improve outputs.

We have already looked at the collection of data from engineering activities, including the dimensions of components, and methods for determining whether or not a component is within specified tolerances.

Collecting data

ACTIVITY

Collect at least ten of the same type of component or product that nominally have the same dimensions – for example, machine screws or mass-produced components such as injection-moulded bottle lids.

1 Measure and record the dimensions of each of the components you collected.
2 Plot the dimensions of the components on a line graph.
3 Write a short summary report to explain your findings.

Table 3.20: Example of data collected for a component that has a required length of 25 mm

Test number	Length measurement (mm)
1	25
2	25
3	25
4	23.5
5	27
6	26
7	24
8	27
9	26
10	23

Once you have collected and recorded your data, as shown in Table 3.20, for example, plot the measurements on a line graph. This will help you to identify any trends or patterns.

The raw data do not show trends easily. However, by plotting the points on a graph, you can spot if there are any patterns or erroneous values that need to be investigated further.

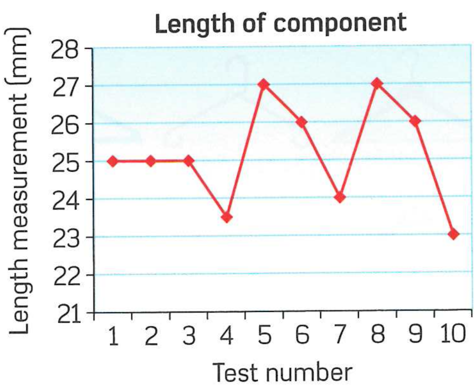


Figure 3.31: Chart showing the results from Table 3.20 in inspection order

Although the data shown in Figure 3.31 are representative of the results found in the sequence of tests during the inspection, it can be more useful to present the data in a more logical way.

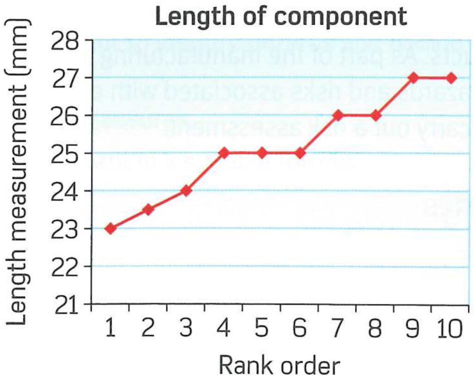


Figure 3.32: Chart showing results in rank order

Looking at the two ways of presenting the same data, the graph in Figure 3.32 allows us to see more easily that three components are smaller than the nominal length and four components are longer than the required length.

Quantitative and qualitative data types

Quantitative data relate to information that is expressed in numbers, such as an item's height, the number of products, or the length of a component, like the example in Table 3.20. These are numerical quantities that can be measured.

Qualitative data give information about a product's characteristics, and are used to describe features of an item, such as the colour or shape of a product. These data are difficult or impossible to measure and are not expressed in terms of numbers. However, if you were to count, for example, the number of red products, then the data would become quantitative.

In engineering, data collected for analysis of statistical trends and patterns generally fall within the quantitative data type, but both types of data are useful and important to know about.

Analysing data

Analysing the results in Figures 3.31 and 3.32 does not really show any trends, so it is more than likely that the differences in size are down to marking-out errors or operator mistakes.

Remember to present your data in a way that is easy to interpret. It is generally a good idea to present data in rank order so that any trends and patterns can be identified more easily.

We looked at the causes of faults in production earlier in Component 3, and classified faults as being either random or systematic. It is much easier to identify systematic faults, and therefore devise solutions for this type of fault, than to identify random faults, so this is where efforts need to be concentrated. A systematic fault will usually give rise to a pattern or trend.

You should analyse data, first, to decide if faults are random or systematic and, second, to think about solutions to the problem.

CHECK MY LEARNING

You have examined different sets of data and looked at the methods used to present data to make them easier to interpret.

Think about the best way to present each of the following types of data:

- the length of time taken to set up a pillar drill
- the number of faults in an electronic circuit
- the actual measured resistance values of resistors.

Safety considerations

GETTING STARTED

Risk assessments were covered in Component 2: Learning aim B. Can you remember the main aims of a risk assessment?

All aspects associated with the manufacture of engineered products will have some elements of risk. These include the materials, substances and processes used to manufacture the products. As part of the manufacturing process, it is important that you are aware of the hazards and risks associated with each of these. One way of approaching this is to carry out a risk assessment.

Risk assessments

The Health and Safety Executive (HSE) is responsible for regulating workplace safety. All employers, including manufacturing companies, can try to keep their employees safe by conducting and using risk assessments. For any employer that has more than five members of staff, these risk assessments need to be recorded in writing.

The HSE recommends that a risk assessment is carried out in five steps:

1 Identify the hazards.
2 Decide who might be harmed and how.
3 Evaluate the risks and adopt associated control measures.
4 Record and action your significant findings.
5 Review your assessment and update if necessary.

An example of a risk assessment is set out in Table 3.21.

Remember that for hazardous substances, you should make sure that control measures meet with the requirements of COSHH (Control of Substances Hazardous to Health) Regulations 2002.

You should also think about the length of time people will be exposed to risks; for example, ear defenders are acceptable for short-term exposure to noise, but for long-term exposure, a permanent method of reducing noise would be better.

LINK IT UP

Each stage of the risk assessment process has been explained in detail in Component 2: Learning aim B. It is important that all stages of the process are completed in full and are accurate in detail.

Table 3.21: Example of a risk assessment

What are the hazards?	Who might be harmed and how?	What are you already doing?	What further action is necessary?	Action by whom?	Action by when?	Done
Tools on the floor in an untidy workshop	Staff or visitors to the workshop might trip over or slip on the tools on the floor causing serious injury	Daily housekeeping at the end of the shift	Better housekeeping – ensure tools and equipment are cleared away immediately after use and not left until the end of the day	Production supervisor	Now	01/09/17
			Improve tool and equipment storage in the work area	Site maintenance manager	14/09/17	01/09/17

ACTIVITY

Investigate the materials and processes you have proposed for use in the manufacture of your chosen design solution.

1 Carry out a risk assessment to identify hazards and decide who might be harmed.
2 Identify suitable control measures.
3 Record your risk assessment in a suitable format.

The use of appropriate PPE is one way of providing control measures for machine operators

DID YOU KNOW?

PPE should not be relied on as the only type of control measure for hazards.

Wherever possible, you should try to eliminate hazards. If this is not possible, see if you can use alternative materials or methods that pose less of a risk.

Considering timescales

You will need to be aware of the timescales that you have to keep when designing an improved engineering product. You will only have a limited amount of time in your external assessment, so you will need to manage this time well. You should avoid spending too much time on one activity, and make sure you attempt each part of the assessment activity.

CHECK MY LEARNING

You have thought about the hazards that can be present during an engineering process and you have investigated control measures, including the use of PPE.

With a partner, write out a risk assessment for one engineering process, such as a turning operation on a lathe. When you have finished, compare your risk assessment with that of another pair in your class group – are there any risks or actions they included that you didn't? Think about and discuss the reasons for any differences.

Learning aim C: assessment practice

How you will be assessed

In this component, you will be assessed by completing a set task that consists of two parts, worth 60 marks in total, and marked by Pearson examiners. Learning aim C is assessed mainly through Part 2 of the set task, which will take place over one and a half hours.

Part 2 will consist of two activities that target higher-order planning, redesign and evaluation skills and which relate to given scenarios. In the set task you will show that you understand how to interpret information and use this to suggest improvements to an engineered product.

You will be assessed on how detailed your evaluation of the existing design is. If you make very basic points only, or ones that are not relevant to the problem, you will receive marks in the lowest marking band. If, however, you identify relevant issues with the design that you are presented with, and then evaluate these issues in detail to show that you fully understand the existing design and how it relates to the design brief, you will be awarded marks in the highest marking band.

Unlike in the practice activities, you will only be asked to produce one design idea in the external assessment, so you need to ensure that this one idea meets all the requirements of the brief and addresses all the areas for improvement you have identified in your evaluation.

If these aspects are not included in your responses, then you will not be able to achieve the higher marks. It is important that you annotate your work clearly to ensure that the person who is marking your designs can understand what you have done.

Remember that the examiner who will be marking your set task does not know you, and the only way they will be able to assess your engineering skills is through the work that they see you have completed.

CHECKPOINT

Strengthen

- Identify four types of engineering drawing.
- Give two reasons why engineers make prototypes.
- Why do engineers use risk assessments?

Challenge

- Explain the difference between a random fault and a systematic fault.
- Describe two approaches to improve an engineering solution.
- Explain why it is important to consider scale of production when improving a design.

ASSESSMENT ACTIVITY | LEARNING AIM C

In the first section of Part 2 of the set task, you were given a brief for an engineered product and an example of a design for the product. You then evaluated the existing product and identified its strengths and weaknesses, as well as its limitations and constraints. You will use this evaluation to help redesign the product for this second section of Part 2 of the set task.

Your teacher has previously given you an example of the engineered product, along with details of how the product was manufactured. Using this information and your previous evaluation, you need to:

1 Produce one idea for the product that shows an improvement on the original design.

2 Justify why your design idea is an improvement and explain which processes you would use to make the redesigned product.

TAKE IT FURTHER

When you explain the processes that you would use to make your design idea, you should justify their use by taking into consideration the materials that you have chosen, the intended purpose and function of the product, and also the scale of production, if this is included in the brief.

TIPS

When you redesign the given engineered product, make sure that the design shows an improvement on the original and that you justify your design solution fully.

Draw your designs clearly and make sure that all the details are shown. Sometimes it is better to draw a number of 2D views rather than produce only one 3D drawing.