

Pearson BTEC Level 3 Nationals Extended Certificate

Engineering

Unit 3: Engineering Product Design and Manufacture

Part A

Set task release date: 30/04/2018

Paper Reference

31708H

You do not need any other materials.

Instructions

- **Part A** contains material for the completion of the preparatory work for the set task.
- **Part A** should be undertaken over no more than 3 hours in a period of 1 week as timetabled by Pearson.
- **Part A** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part B** materials must be issued to learners during the period specified by Pearson.
- This **Part A** task booklet must not be returned to Pearson.

Information

- In **Part B**, the task should be undertaken in 8 hours under supervision over no more than 5 consecutive working days. The supervised sessions take place in the two-week period timetabled by Pearson

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Instructions to teachers

This paper must be read in conjunction with information on conduct for the task in the unit specification and the BTEC Nationals Instructions for Conducting External Assessments (ICEA) document. For further details please see the Pearson website.

Part A should be issued to learners one week prior to undertaking **Part B** of the assessment.

Learners will be expected to conduct research.

Research is expected to be carried out over 3 hours. Centres must advise learners of the timetabled sessions during which they can carry out the research. It is expected that scheduled lessons or other timetable slots will be used for some or all of this work.

Learners can produce individually prepared research notes (maximum of two sides of A4) to take into the **Part B** supervised assessment.

Teachers cannot give any support to the production of the notes and the work must be completed independently by the learner.

For **Part B**, centres are free to arrange the supervised assessment period how they wish provided the 8 hours for producing final outcomes are completed over no more than 5 consecutive days, are under the level of supervision specified and in accordance with the conduct procedures.

Refer carefully to the instructions in this task booklet and the Instructions for Conducting External Assessments (ICEA) document to ensure that the preparatory period is conducted correctly and that learners have the opportunity to carry out the required activities independently.

Learner research notes will be retained securely by the centre after **Part B** and may be requested by Pearson if there is suspected malpractice.

Instructions for Learners

Read the set task information carefully.

This contains **Part A**, which is the information you need to prepare for the set task.

You will need to carry out your own research over the next week and you can take up to two A4 sides of individually prepared research notes into **Part B** of the set task.

You will then be given the set task to complete under supervised conditions.

For **Part A**, you must work independently and must not share your work with other learners.

Your teacher will give guidance on when the preparation should be completed.

Your teacher cannot give you feedback during the preparation period.

Set Task Brief

You are advised to spend a maximum of three hours doing your research.

A client has asked you, as a junior design engineer, to redesign the filter in a tumble dryer, as it is not working effectively. The filter is used to prevent the build of fluff within the vent pipe. The fluff is a by-product of the tumble drying process.

You will research the design and manufacturing requirements that are relevant to the filter and its use. Your research should consider:

- the function of a filter in a tumble dryer
- existing designs for filters
- the manufacturing processes and technologies that are being used and possible alternatives
- the health and safety requirements for the product, user and manufacturing processes.
- environmental considerations including sustainability
- material requirements and suitable material properties
- any other relevant factors, such as removal and cleaning.

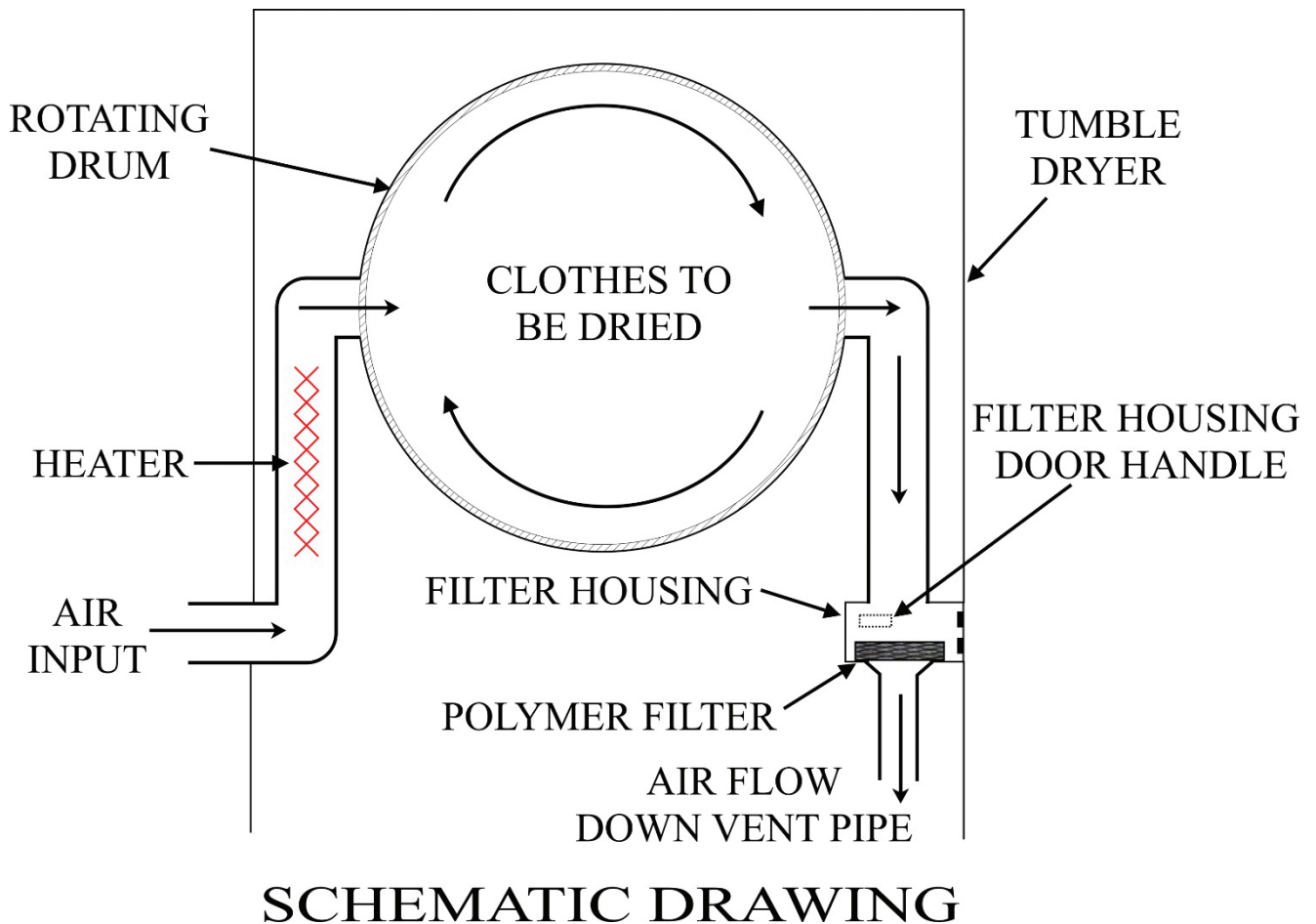
In **Part B** you will be given further information on the specific issues with the existing polymer filter that will allow you to redesign the filter and evaluate your solution against the issues. Therefore, you are advised not to undertake any design work during **Part A** (the research stage).

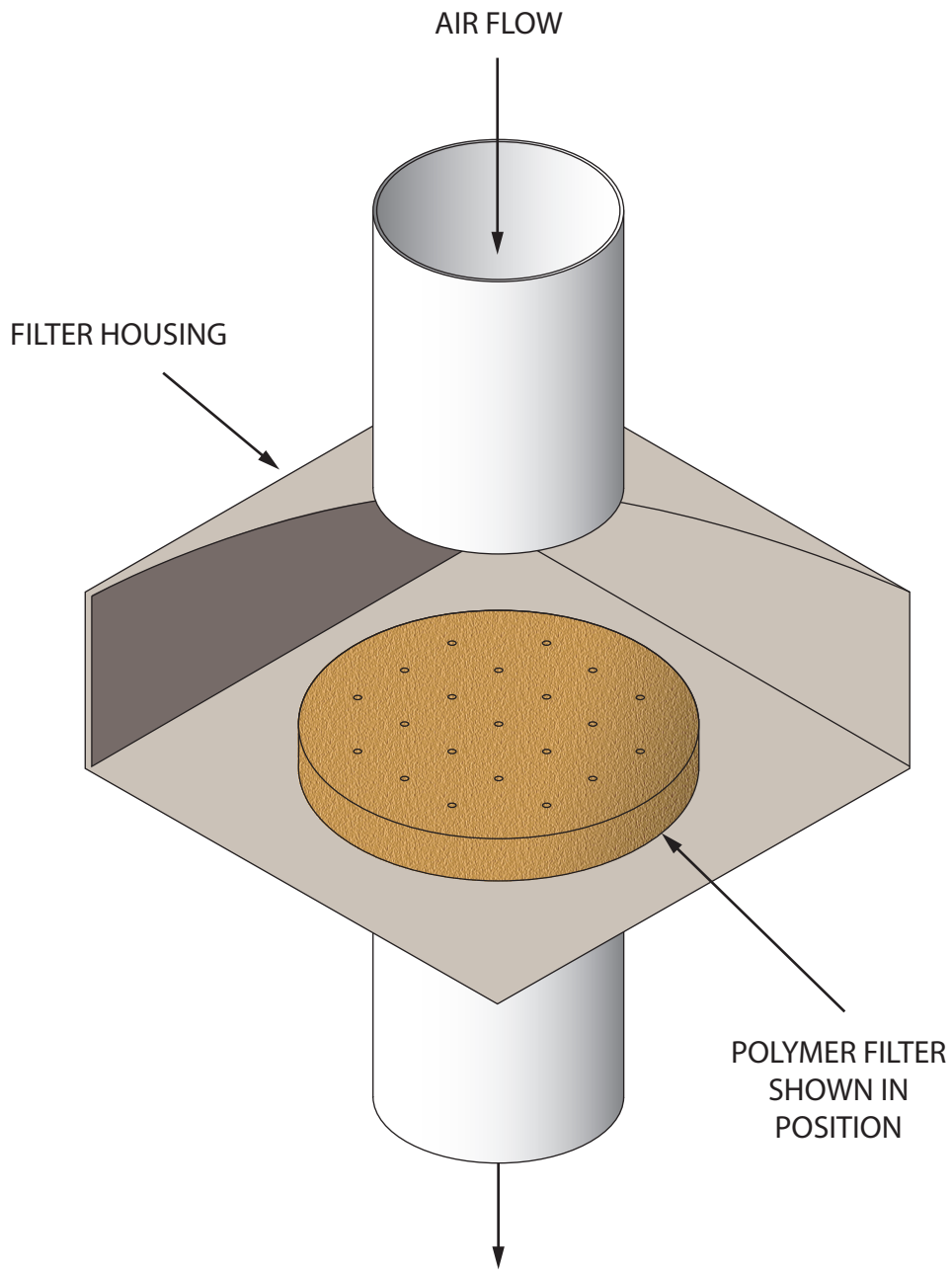
You will be able to take up to two sides of individually prepared A4 research notes from **Part A** into **Part B** of the set task.

Part A Set Task Information

The product is a filter for a tumble dryer. The filter is designed to capture fluff from the tumble drying process. The filter is placed into the filter housing behind the filter housing door during assembly by the manufacturer.

One filter is needed for each tumble dryer. Currently, the filter is manufactured from a polymer in batches of 100,000.





FILTER HOUSING DIMENSIONS L175mm W175mm H65mm
FILTER HOUSING WITH PIPEWORK

'CUT AWAY' VIEW

Pearson BTEC Level 3 Nationals Extended Certificate

Engineering

Unit 3: Engineering Product Design and Manufacture

Part B

Window for Supervised Period: 08/05/2018 to
21/05/2018

Information booklet

Paper Reference

31708H

Do not return this Information Booklet with the question paper.

Instructions

- You will need the information in this booklet to complete the task.
- Read the information carefully.
- You must **not** write your answers in this booklet.
- Only your answers given in the task booklet in **Part B** will be marked.

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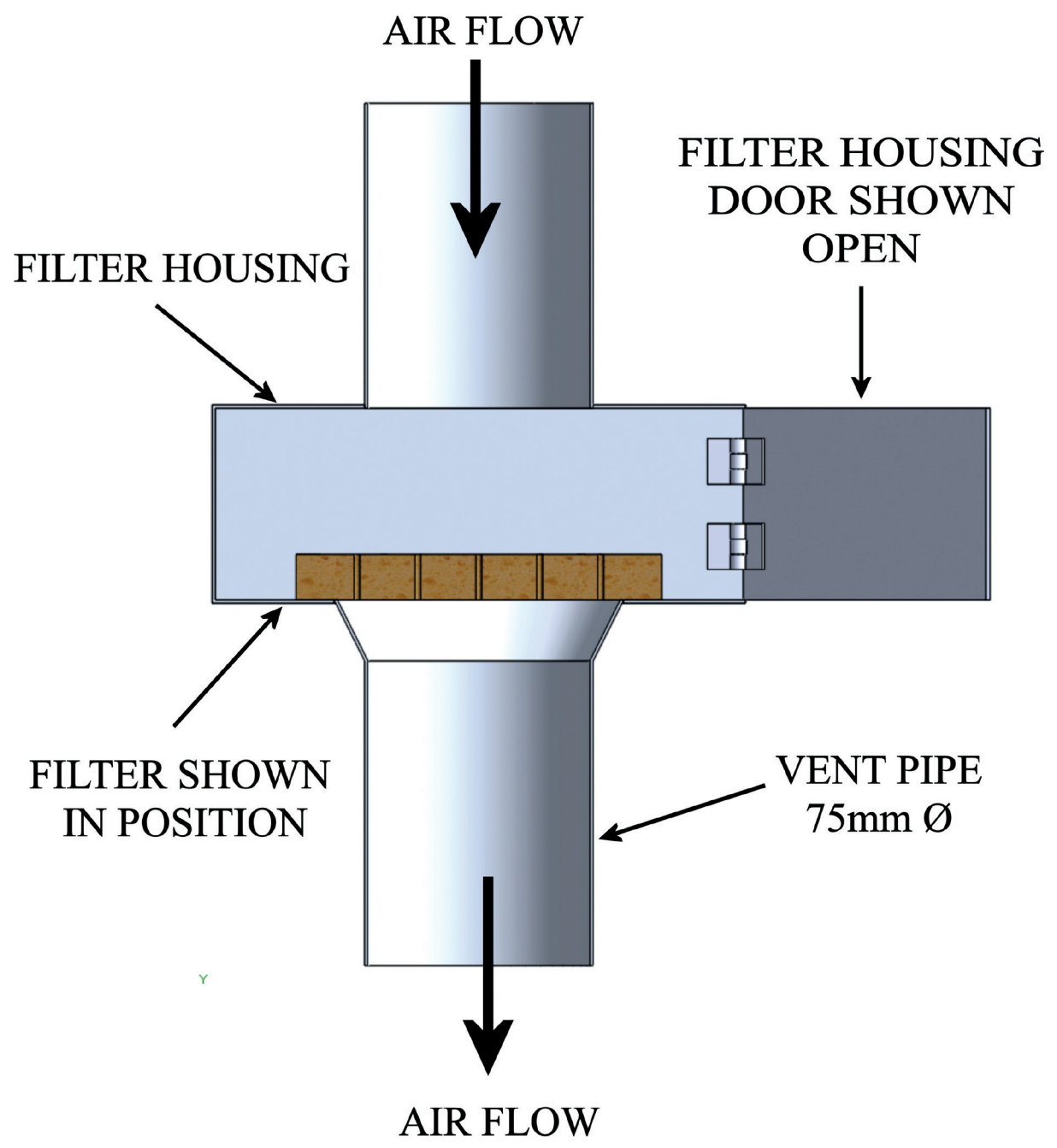
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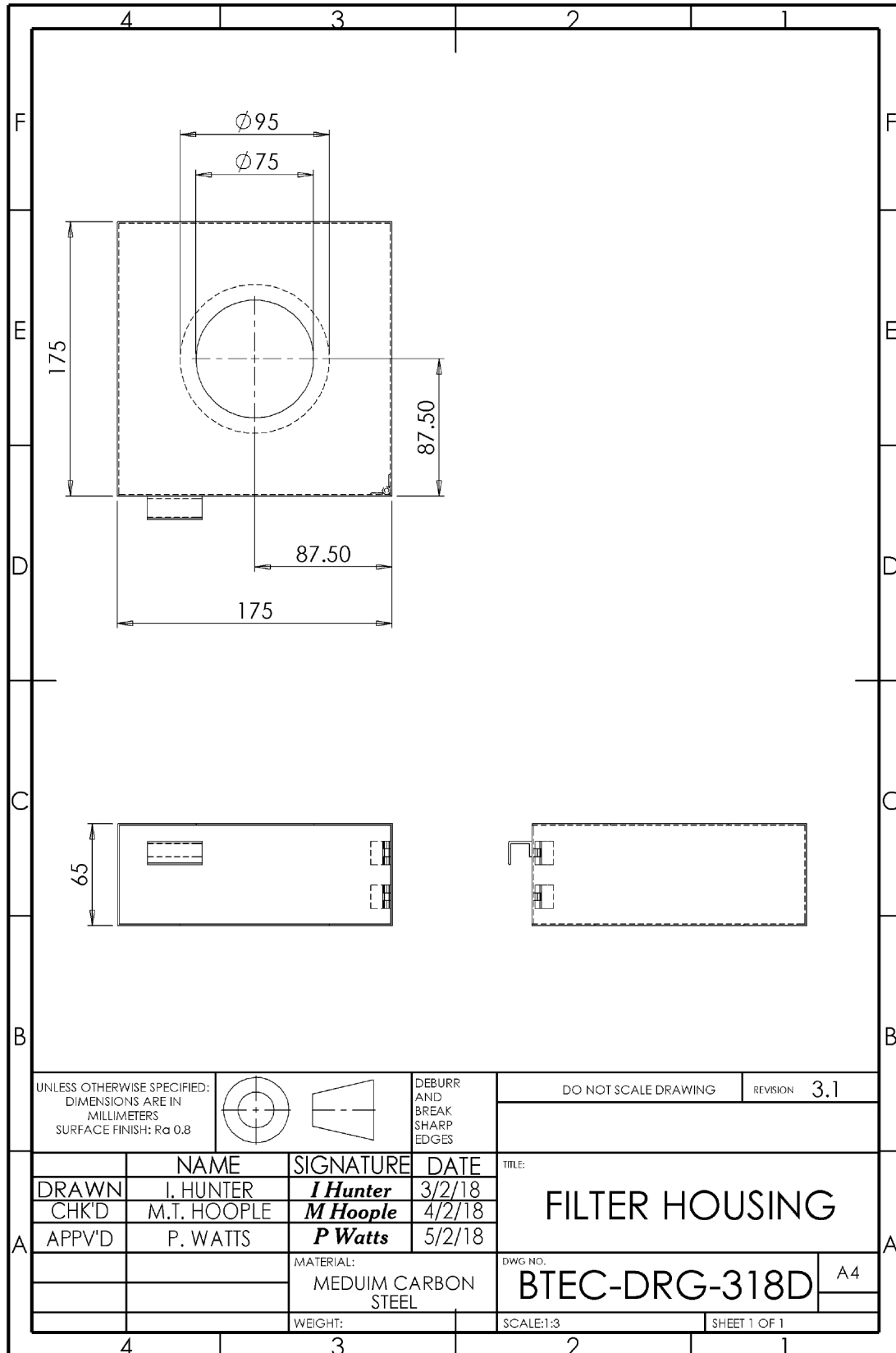
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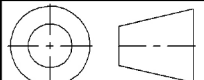
FILTER HOUSING WITH PIPEWORK

FRONT VIEW





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MILLIMETERS
SURFACE FINISH: Rg 0.8



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AND
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SHARP
EDGES

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REVISION 3.1

	NAME	SIGNATURE	DATE
DRAWN	I. HUNTER	<i>I Hunter</i>	3/2/18
CHK'D	M.T. HOOPLE	<i>M Hoople</i>	4/2/18
APPV'D	P. WATTS	<i>P Watts</i>	5/2/18

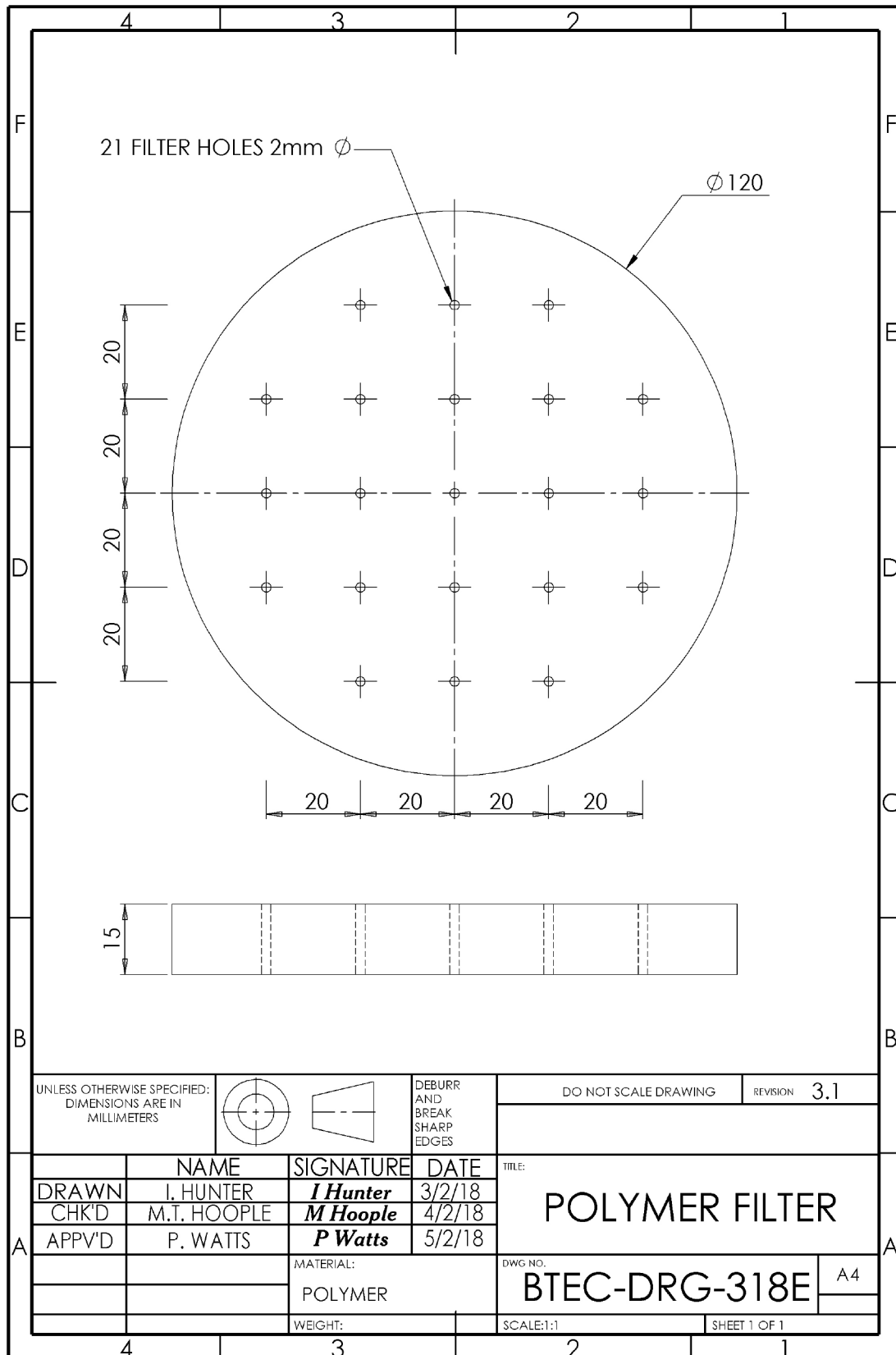
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FILTER HOUSING

MATERIAL:
MEDIUM CARBON
STEEL

DWG NO. **BTEC-DRG-318D** A4

WEIGHT:

SCALE:1:3 SHEET 1 OF 1



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APPV'D	P. WATTS	<i>P Watts</i>	5/2/18

TITLE:

POLYMER FILTER

MATERIAL:	
POLYMER	
WEIGHT:	

DWG NO.

BTEC-DRG-318E

A4

SCALE:1:1

SHEET 1 OF 1



Write your name here

Surname	Other names
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**Pearson BTEC
Level 3 Nationals
Extended
Certificate**

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Engineering

Unit 3: Engineering Product Design and Manufacture

Part B

Window for Supervised Period: 08/05/2018 to 21/05/2018 Controlled hours: 8 hours	Paper Reference 31708H
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You must have: Information Booklet containing engineering drawings (enclosed), HB or B pencil, ruler, eraser, drawing instruments and calculator.	Total Marks
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Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- You will need your research notes from **Part A** (maximum two A4 sides).
- **Part B** should be undertaken in 8 hours under supervision over no more than 5 consecutive working days. The supervised sessions take place in the two-week period timetabled by Pearson.
- **Part B** contains material for the completion of the set task under supervised conditions.
- **Part B** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part B** should be kept securely until the start of the 8-hour supervised assessment period.
- You must not submit your research notes to Pearson.
- Answer **all** activities.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every activity.
- Check your answers if you have time at the end.

Turn over ►

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Instructions to Teachers and/or Invigilators

This paper must be read in conjunction with information on conduct for the task in the unit specification and the BTEC Nationals Instructions for Conducting External Assessments (ICEA) document. For further details please see the Pearson website.

The set task should be carried out under supervised conditions.

Work should be completed in this task booklet, using additional sheets if necessary.

Learners can use individually prepared research notes (maximum two sides of A4) to support the supervised assessment (**Part B**). These research notes must be kept secure once the supervised assessment has begun.

All learner work must be completed independently and authenticated before being submitted to Pearson by the teacher and/or invigilator.

Centres are free to arrange the supervised assessment period how they wish, provided the 8 hours for producing final outcomes are under the level of supervision specified, and in accordance with the conduct procedures. The assessment must take place in a two week period set by Pearson, once the learner has started **Part B** the assessment must be completed in 5 consecutive working days.

Refer carefully to the instructions in this task booklet and the Instructions for Conducting External Assessments (ICEA) document to ensure that the assessment is supervised correctly. An authentication statement will be required confirming that learner work has been completed as directed.

Learners must not bring anything into the supervised environment or take anything out without your knowledge and approval.

Centres are responsible for putting in place appropriate checks to ensure that only permitted material is introduced into the supervised environment.

Maintaining security

- For **Part B**, learners **must not** have access to computers or the internet.
- Learners can only access their work under supervision.
- Any work learners produce under supervision must be kept secure.
- Any materials being used by learners must be collected in at the end of each session, stored securely and handed back at the beginning of the next session.

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Outcomes for Submission

One task booklet will need to be submitted by each learner, which includes the following tasks:

- the project planning and product design changes made during the development process
- interpretation of the brief into operational requirements
- a range of (three or four) initial design ideas based on the client brief
- a modified product proposal with relevant design documentation
- an evaluation of the design proposal
- a fully completed authentication sheet must be completed by each learner.

Learner research notes will be retained securely by the centre after **Part B** and may be requested by Pearson if there is suspected malpractice.

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Instructions for Learners

Read the set task information carefully.

You must plan your time accordingly and be prepared to submit all the required evidence by the date specified.

You should use your preparatory work from **Part A** to complete the set task in **Part B**.

Your preparatory notes from Part A will not be submitted with the task booklet from Part B. Only your task booklet from Part B will be submitted to Pearson for marking.

You will complete this set task under supervision and your work will be kept securely during any breaks taken.

For **Part B**, you **must not** use computers or the internet.

You must work independently throughout the supervised assessment period and must not share your work with other learners.

In the information booklet you will be provided with drawings of the polymer filter and filter housing.

Outcomes for submission

You will need to submit one task booklet on completion of the supervised assessment period, which includes the following activities:

- a record of the project planning and product design changes made during the development process
- interpretation of the brief into operational requirements
- a range of (three or four) initial design ideas based on the client brief
- a modified product proposal with relevant design documentation
- an evaluation of the design proposal.

A fully completed authentication sheet must also be submitted; any prepared research notes do not need to be submitted with the final outcomes to Pearson.

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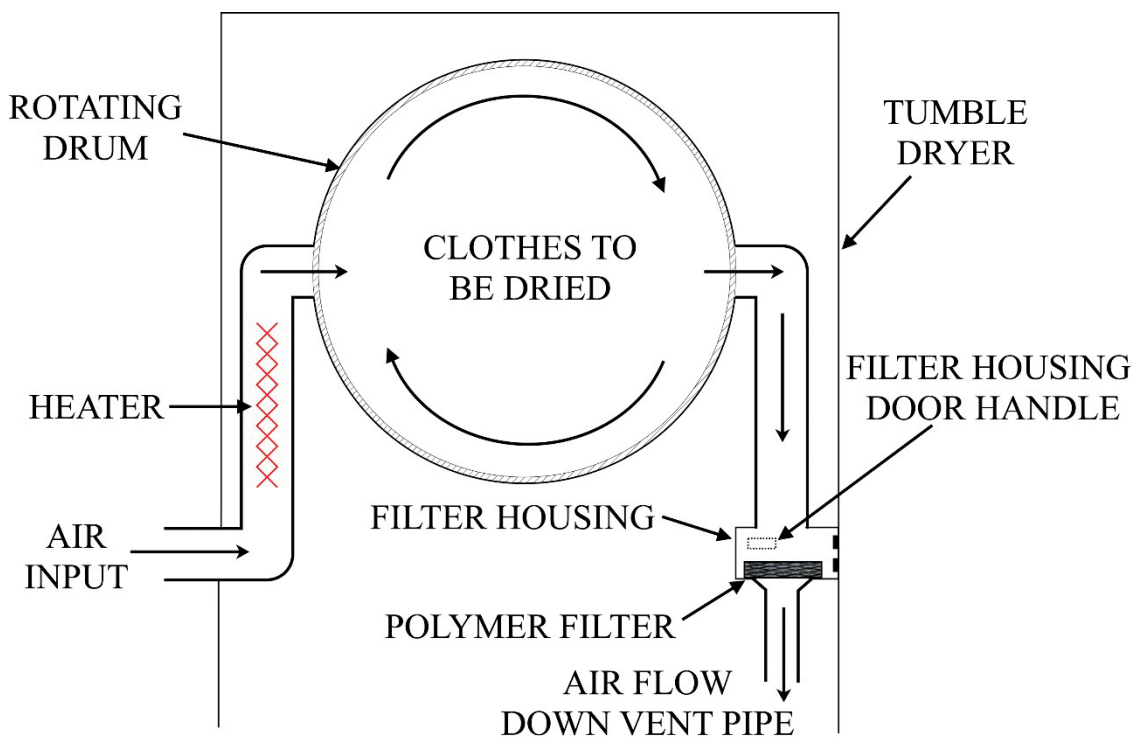
Part A Set Task Brief

A client has asked you, as a junior design engineer, to redesign the filter in a tumble dryer, as it is not working effectively. The filter is used to prevent the build of fluff within the vent pipe. The fluff is a by-product of the tumble drying process.

Part A Set Task Brief Information

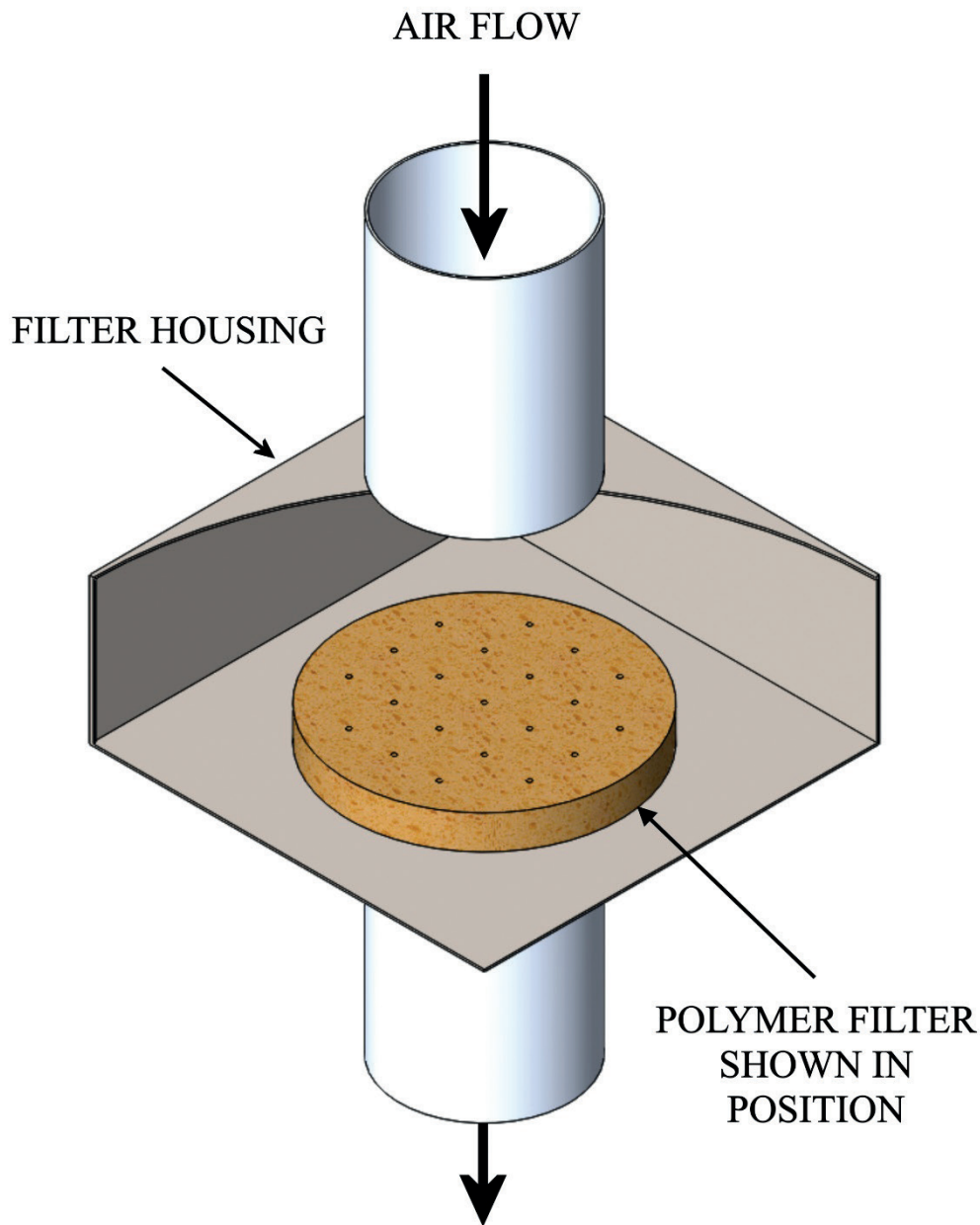
The product is a filter for a tumble dryer. The filter is designed to capture fluff from the tumble drying process. The filter is placed into the filter housing behind the filter housing door during assembly by the manufacturer.

One filter is needed for each tumble dryer. Currently, the filter is manufactured from a polymer in batches of 100,000.



SCHEMATIC DRAWING





FILTER HOUSING DIMENSIONS L175mm W175mm H65mm

FILTER HOUSING WITH PIPEWORK

'CUT AWAY' VIEW

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Part B Set Task Information

For **Part B**, you are allowed to use your individually prepared research notes from **Part A** to support you during the supervised assessment period.

In the information booklet, you are provided with drawings of the polymer filter and filter housing.

Client brief

The client is aware that the current polymer filter has many issues, but the redesign has been triggered by complaints from customers about how difficult it is to use. Customers have provided feedback that the polymer filter is not effective for a number of reasons.

The client believes that the source of the issues are problems with the positioning, removal and cleaning of the polymer filter; however, redesign of the filter housing and the other parts of the tumble dryer are not possible.

The client has also provided test data to show the amount of fluff that is bypassing the polymer filter during use and the amount of fluff that is going down the vent pipe during filter removal for cleaning. Both of these issues reduce the efficiency of the tumble dryer and cause it to overheat, meaning it stops operating. The test data in Table 1 and Table 2 can be used to perform a statistical analysis of the in-service use of the polymer filter.

The client needs you to design a new and improved filter to fit into the existing filter housing. Your solution must take into account the most efficient use of materials and manufacturing processes as well as safety, form, sustainability and other factors. You also have an opportunity to reduce the issues with the existing design of the filter by considering equipment interfaces and retrofitting other low cost components.

The filter **must**:

- capture a very high percentage of fluff whilst allowing maximum air flow
- be robust enough to last the lifetime of a tumble dryer
- be removable for cleaning without using excessive force or the use of tools.
- locate into the existing filter housing within the tumble dryer.
- be capable of being mass produced in batches of 100,000.



Outcome of test data for different sizes

Table 1 – Effect of changing the polymer filter diameter (hole diameter = 2 mm)

Polymer filter design	Polymer filter diameter (mm)	Amount of fluff going down the vent pipe during the polymer filter removal (grammes)				
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
A	110	25	27	29	27	28
B	120	20	21	21	24	19
C	130	15	16	15.5	17	14.5
D	140	10	12	11	13	9

Table 2 - Effect of changing the hole diameter (polymer filter diameter = 120 mm)

Polymer filter design	Hole diameter (mm)	Amount of fluff going down the vent pipe during use (grammes)				
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
E	1	1.2	0.5	1.25	1.25	1
F	2	2.2	2.25	2.5	2.5	2.25
G	3	3.25	3.7	3.4	3.75	3
H	4	4.7	4.75	4.5	5	5.1

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Redesign of the product

Activity 1

At the start of the task create a short outline project time plan in your task booklet.

During the other activities (2 to 5), you should also record **in the Activity 1 section** of your task booklet:

- why changes were made to the design during each session
- action points for the next session.

(Total for Activity 1 = 6 marks)

Suggested time 45 minutes

Activity 2

Interpret the client brief into operational requirements, to include:

- product requirements
- opportunities and constraints
- interpretation of numerical data
- key health and safety, regulatory and sustainability factors.

(Total for Activity 2 = 6 marks)

Suggested time 45 minutes

Activity 3

Produce a range of (three or four) initial design ideas based on the client brief, to include:

- sketches
- annotations.

(Total for Activity 3 = 9 marks)

Suggested time 1 hour 15 minutes



Activity 4

Develop a modified product proposal with relevant design documentation.

The proposal **must** include:

- a solution including a final drawing.

The proposal **must** consider:

- existing products
- materials
- manufacturing processes
- sustainability
- safety
- other relevant factors.

(Total for Activity 4 = 30 marks)

Suggested time 4 hours

Activity 5

Your final task booklet entry **must** evaluate:

- success and limitations of the completed solutions
- indirect benefits and opportunities
- constraints
- opportunities for technology-led modifications.

(Total for Activity 5 = 9 marks)

Suggested time 1 hour 15 minutes

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ACTIVITY 1 BEGINS ON THE NEXT PAGE.



Activity 1

At the start of the task create a short outline project time plan in your task booklet.

During the other activities (2 to 5), you should also record **in the Activity 1 section** of your task booklet:

- why changes were made to the design during each session
- action points for the next session.

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(Total for Activity 1 = 6 marks)



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(Total for Activity 2 = 6 marks)



Activity 3

Produce a range of (three or four) initial design ideas based on the client brief, to include:

- sketches
- annotations.

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(Total for Activity 3 = 9 marks)



Activity 4

Develop a modified product proposal with relevant design documentation.

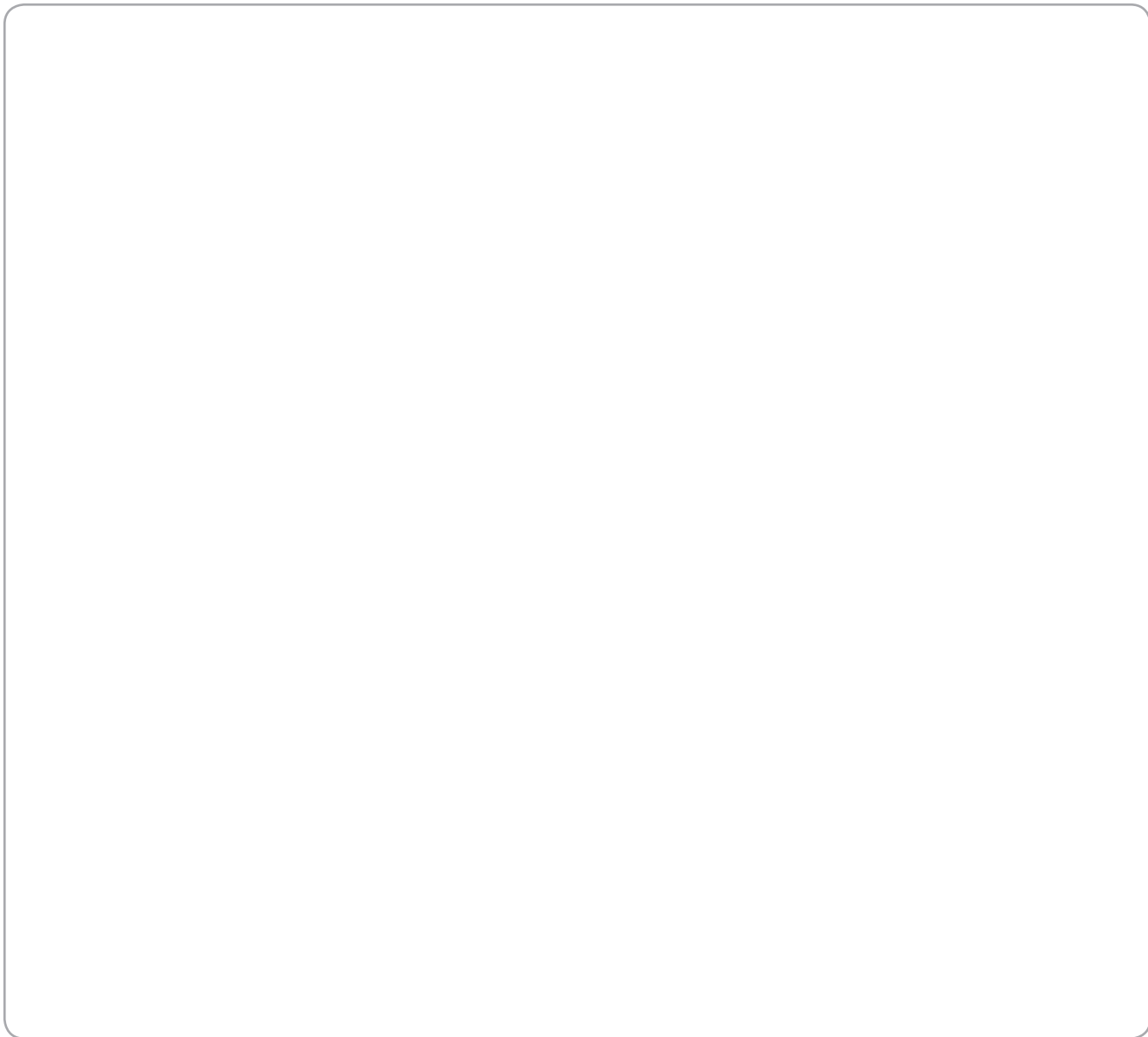
The proposal **must** include:

- a solution including a final drawing.

The proposal **must** consider:

- existing products
- materials
- manufacturing processes
- sustainability
- safety
- other relevant factors.

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(Total for Activity 4 = 30 marks)



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(Total for Activity 5 = 9 marks)

TOTAL FOR TASK = 60 MARKS



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