

Thursday 21 June 2012 – Afternoon

**GCSE DESIGN AND TECHNOLOGY
Electronics and Control Systems**

A514/02 Technical Aspects of Designing and Making: Pneumatics

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:

- A calculator may be used

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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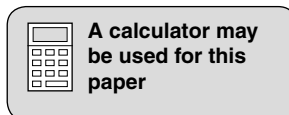
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions in **Section A and Section B**.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Show all your working out for calculations.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Marks will be awarded for the use of correct conventions.
- Your Quality of Written Communication will be assessed in questions marked with an asterisk (*).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **16** pages. Any blank pages are indicated.



Section A

Answer **all** questions.

- 1 Fig. 1 shows a pneumatically controlled machine for extruding and cutting the pastry used in the manufacture of quiche bases.

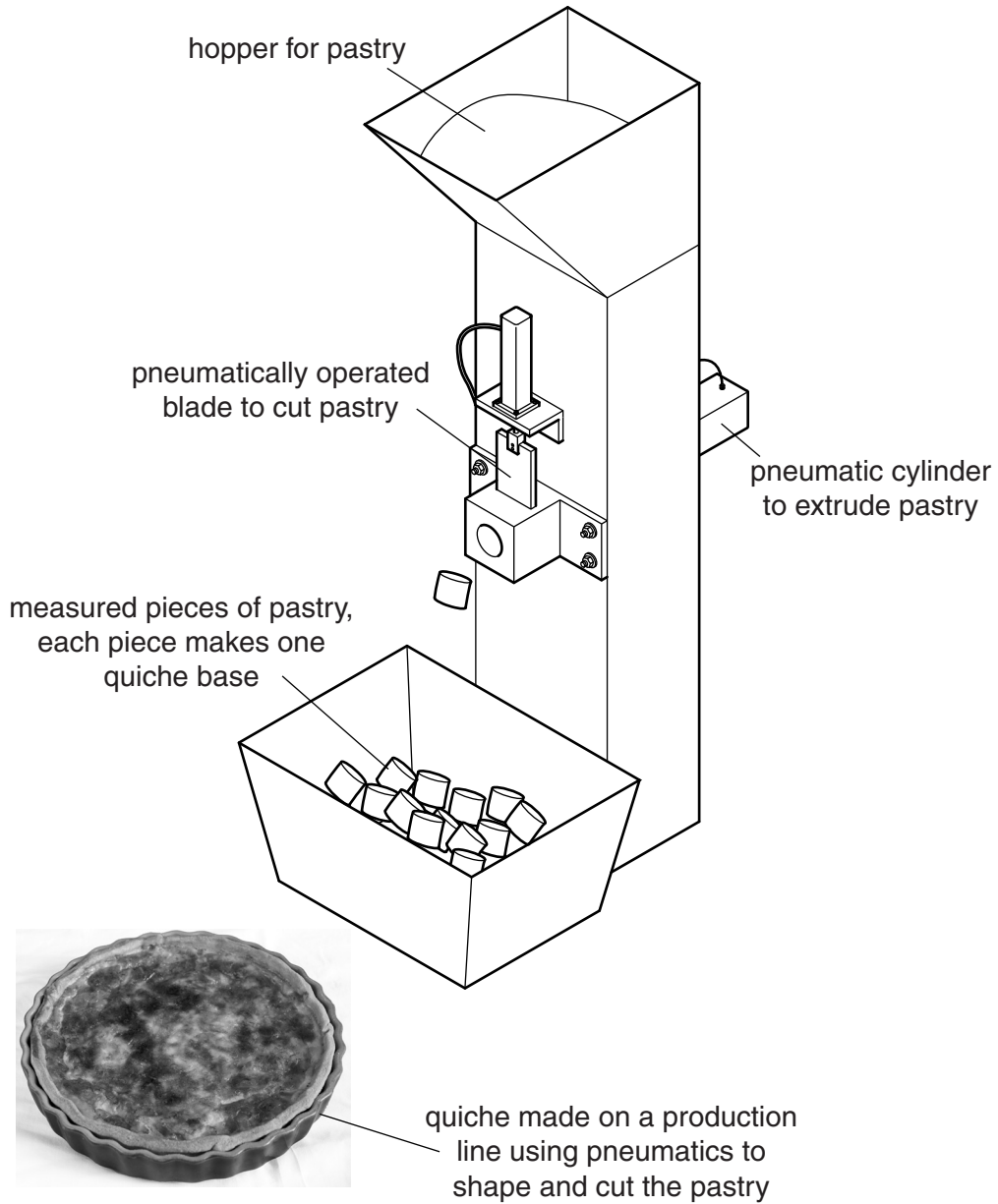
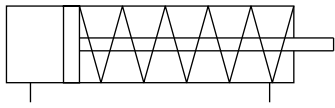
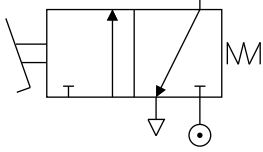


Fig. 1

- (a) The table below shows the name and symbol for some of the components in the pneumatically controlled pastry processing machine. Complete the table by adding the component names and drawing in the component symbols.

component name	component symbol
<p>A pilot air line</p>	
<p>B exhaust line</p>	
<p>C</p>	
<p>D</p> <p>.....</p>	

[1]

[1]

[2]

[2]

- (b) Explain the action of the spring in component **C** shown in the table.

.....

.....

.....

..... [2]

(b) The operation of controlling pneumatic components can be carried out manually or automatically.

Give **two** advantages of using automatic control over manual control.

1

.....

2

..... [2]

(c) One method of automatic control is to use a Programmable Logic Controller (PLC).

Describe **three** benefits of using a PLC for industrial pneumatic systems.

1

.....

2

.....

3

..... [3]

[Total: 12]

- 3 To develop the pastry processing machine cylinder **C** is added to push the pastry into the cutter block as shown in Fig. 4.

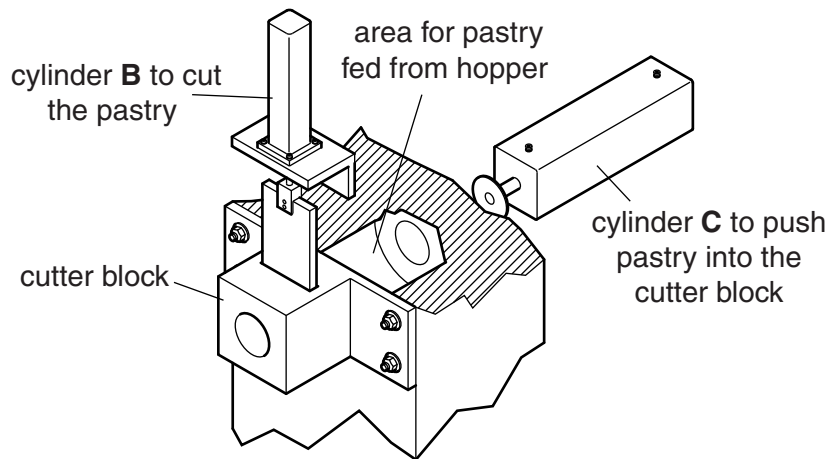


Fig. 4

- (a) Using the letters '**B**' and '**C**' for the cylinders; '+' for outstroke and '-' for instroke, complete the sequence that will:

- push and hold the raw material into the cutting area
- lower the cutter blade
- raise the cutter blade
- withdraw cylinder **C** to allow more pastry to fall from the hopper.

..... [4]

(b) The circuit shown in Fig. 5 produces a logic function.

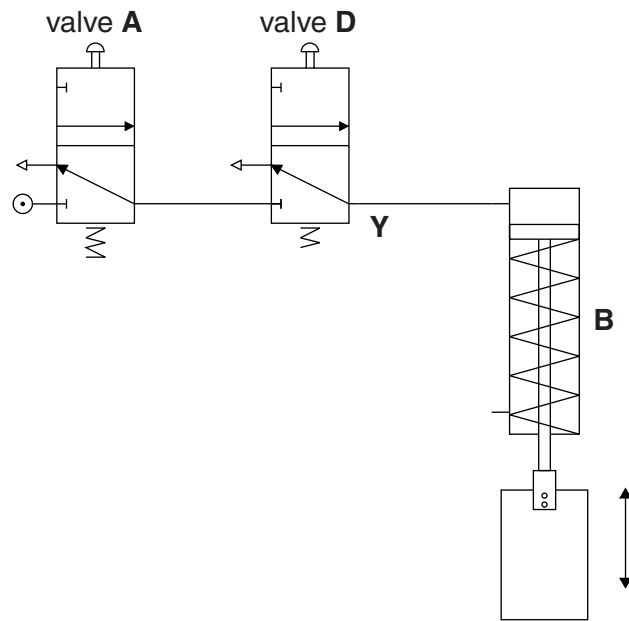


Fig. 5

(i) State the name of the logic function used to operate the cutter.

..... [1]

(ii) Give the reason why health & safety regulations insist on the circuit shown in Fig. 5.

.....
 [1]

Section B

Answer **all** questions.

- 4 Fig. 6 shows cylinder **D** which pushes a cover plate across the face of the cutting block for cylinder **C** to push the pastry against.

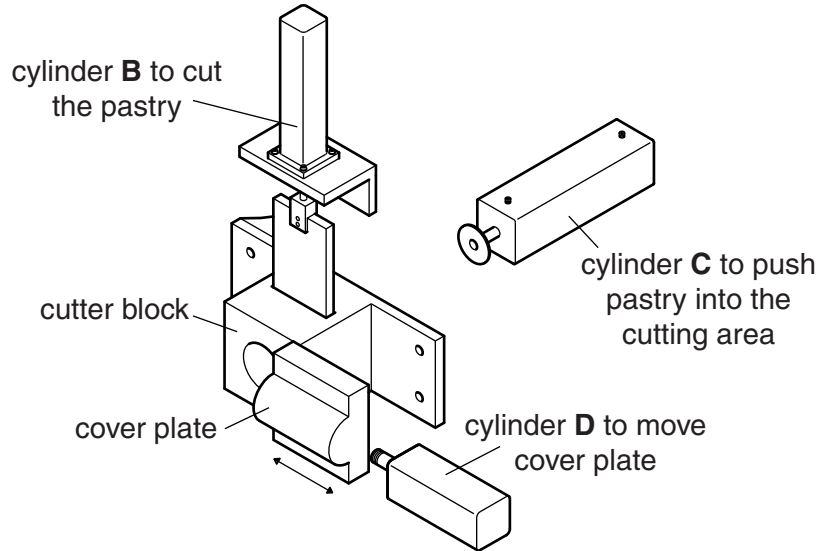


Fig. 6

- (a) Draw an annotated design on Fig. 7 to show a method that will:
- attach the piston rod of cylinder **D** to the cover plate
 - allow the cover plate to slide as required
 - hold the cover plate against the cutter block
 - allow easy removal for cleaning.

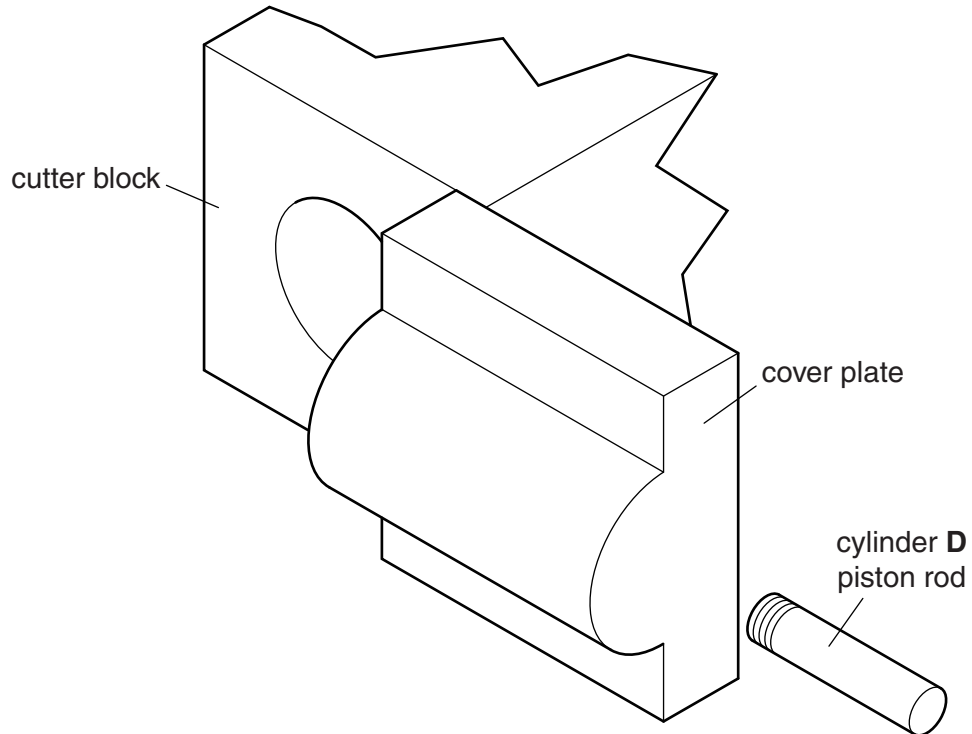


Fig. 7

[6]

5 It is important that cylinder **C** in Fig. 6 applies the correct pressure when pushing the pastry into the cutting area.

(a) If the force required is 50 Newtons and the cylinder diameter is 25 mm calculate the pressure required from the compressor.

Use the formula $F = P \times A$

.....

.....

.....

..... [4]

(b) The maximum pressure available from the compressor receiver is below that which is required to operate the circuit.
Using the same compressor and receiver explain how the circuit can be made to work correctly by changing a component.

.....

.....

..... [3]

(c) (i) To ensure that cylinder **B** is not outstroked when cylinder **C** is pushing pastry into place it is replaced by a reed switch cylinder and a microcontroller is used to operate the process. Fig. 8 shows the reed switch cylinder and part of the microcontroller. Complete Fig. 8 by drawing in the feedback connections to indicate the position of the piston to the microcontroller.

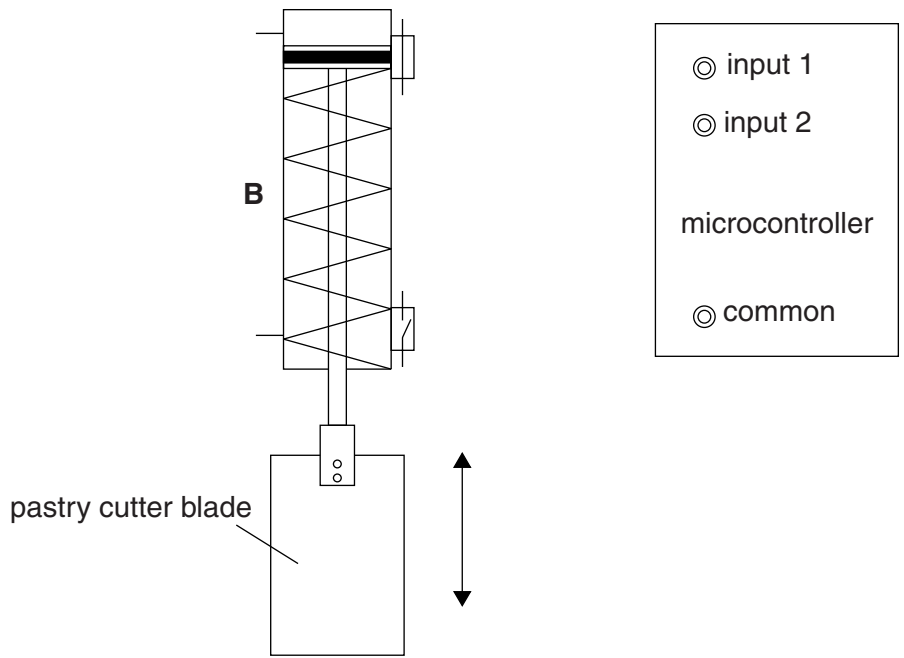


Fig. 8

[3]

(ii) Explain how the switches in Fig. 8 indicate the position of the pastry cutter blade.

.....

.....

.....

..... [2]

[Total: 12]

15
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