

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
 DESIGN AND TECHNOLOGY  
 SYSTEMS AND CONTROL TECHNOLOGY**

Paper 5 Pneumatics (Foundation Tier)

**MONDAY 2 JUNE 2008**

Morning  
 Time: 1 hour

Candidates answer on the question paper

**Additional materials:** No additional materials are required



Candidate Forename

Candidate Surname

Centre Number

Candidate Number

**INSTRUCTIONS TO CANDIDATES**

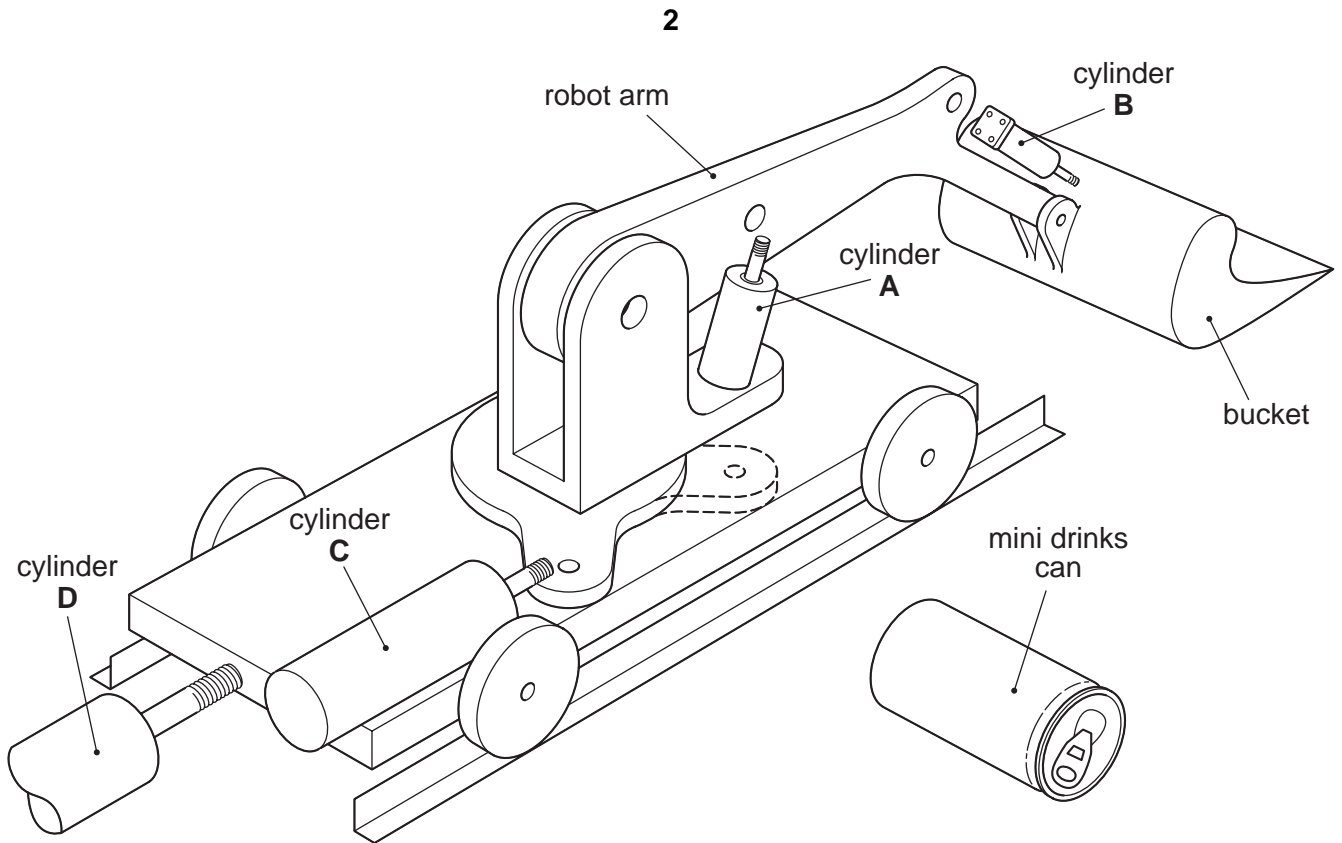
- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **50**.
- Dimensions are in millimetres unless stated otherwise.
- Marks will be awarded for the use of correct conventions.

For Examiner's Use	
1	
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This document consists of **10** printed pages and **2** blank pages.



**Fig. 1**

Fig. 1 shows a demonstration robot. The robot is controlled by pneumatics.

The robot moves forward and backwards on its wheels. The arm and bucket are used to pick up mini drinks cans. The robot arm can be turned through 90° to tip the mini drink cans into a skip.

1 Fig. 2 shows symbols or names of some components used in a pneumatically controlled robot.

(a) Complete the table in Fig. 2 by drawing the missing symbols and adding the missing names.


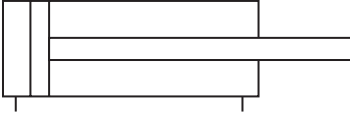
Component Name	Component Symbol
<b>A</b> Reservoir	<div style="text-align: right;">[1]</div>
<b>B</b> .....	 <div style="text-align: right;">[1]</div>
<b>C</b> Single acting spring return cylinder	<div style="text-align: right;">[2]</div>
<b>D</b> ..... .....	 <div style="text-align: right;">[2]</div>
<b>E</b> Bi-directional flow restrictor (FCV)	<div style="text-align: right;">[2]</div>

Fig. 2

(b) Give **two** reasons why a reservoir is used in a pneumatic circuit.

Reason 1 .....[1]

Reason 2 .....[1]

2 The prototype circuit shown in Fig. 3 was built to control the movement of the robot arm shown in Fig. 1.

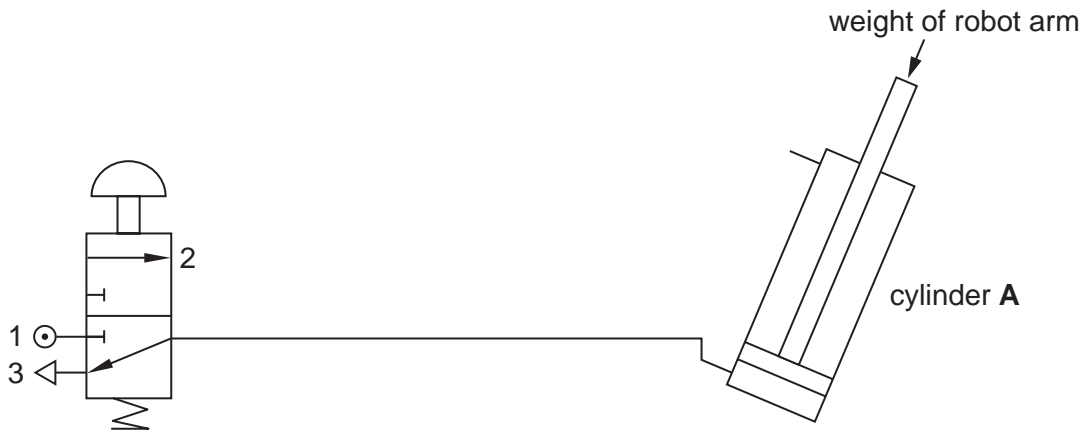


Fig. 3

(a) Name the valve shown in Fig. 3.

.....[2]

(b) When the valve is operated, the robot arm lifts. When released, the arm falls back down very quickly.

(i) Add a uni-directional flow restrictor to the circuit in Fig. 3 to:

- allow the arm to raise quickly;
- make the arm lower slowly.

[3]

(ii) Describe how the uni-directional restrictor works to:

- allow the arm to raise quickly;
- make the arm lower slowly.

.....  
 .....  
 .....  
 .....[3]

(iii) Explain why a double acting cylinder rather than a single acting cylinder has been used in Fig. 3.

.....  
 .....  
 .....[2]

3 An air receiver used to store the compressed air for powering the robot, is fitted with a safety valve and a pressure gauge.

(a) Explain why each of these components is essential to the safe operation of the system.

(i) Safety valve .....  
.....  
.....  
.....  
.....[3]

(ii) Pressure gauge .....  
.....  
.....  
.....  
.....[3]

(b) Give **two** reasons why it is important to check a circuit for any unconnected pipes before turning the main air on for the first time.

Reason 1 .....  
.....  
.....[2]

Reason 2 .....  
.....  
.....[2]

4 Manufacturers of pneumatically controlled robots use computers when:

- designing the control system;
- testing prototype pneumatic circuits;
- controlling pneumatic systems.

(a) State **three** advantages of using CAD to draw design layouts when designing a pneumatic circuit.

1 .....[1]

2 .....[1]

3 .....[1]

(b) State **two** benefits to the manufacturer of using computer simulation to test prototype circuits.

1 .....[1]

2 .....[1]

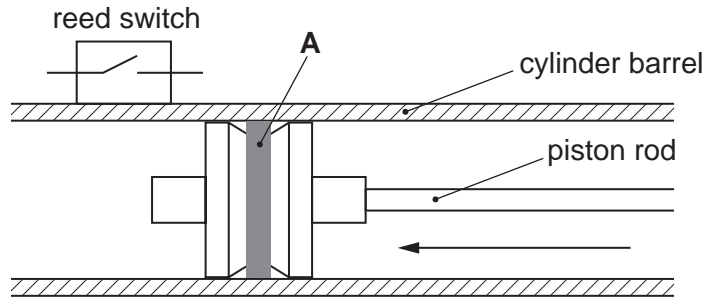
(c) Robots are now used extensively in the manufacturing industry.

State **two** advantages to the manufacturer of changing from manually operated machines to computer controlled robots.

1 .....[1]

2 .....[1]

- (d) A reed switch cylinder is an important part of the interface between the pneumatic operation and the computer control in robotic systems.



**Fig. 4**

Fig. 4 shows a simplified version of a reed switch cylinder.

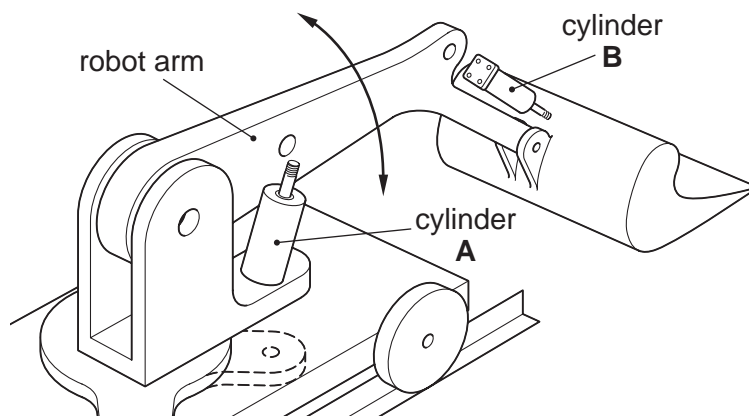
- (i) Name the component **A** in Fig. 4

.....[1]

- (ii) Describe how feedback is provided to the computer when the piston moves in the direction of the arrow shown.

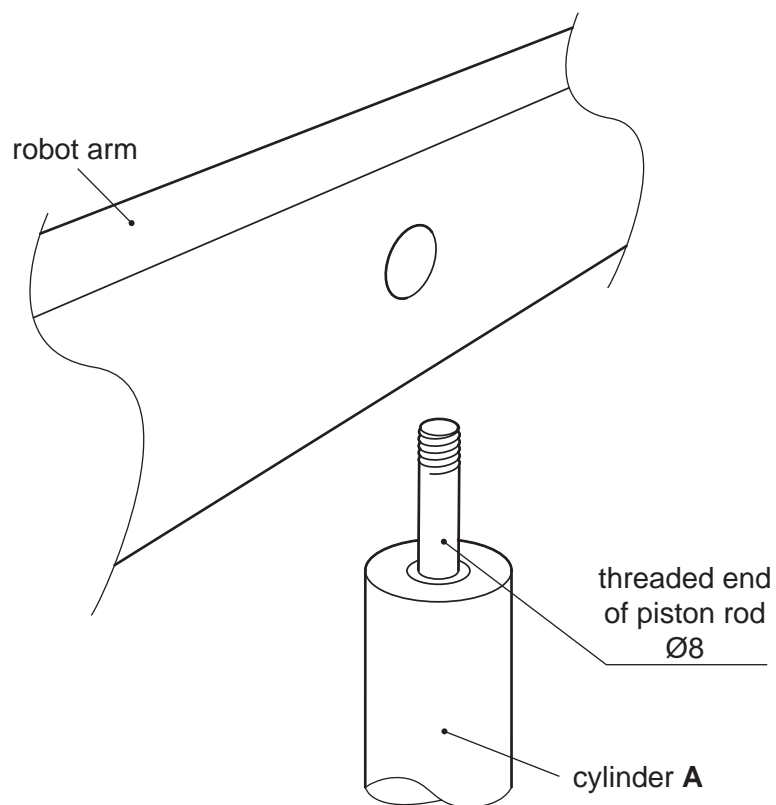
.....  
 .....  
 .....  
 .....[2]

- 5 The robot arm is raised and lowered by cylinder **A** as shown in Fig. 5 below.



**Fig. 5**

Fig. 6 shows details of the threaded end of the piston rod and the robot arm.



**Fig. 6**

- (a) Using sketches and notes, complete Fig. 6 to show a component that will fit on the threaded end of the  $\text{Ø}8$  piston rod and attach to the robot arm allowing the two parts to move as required. [5]



- (b) The rear of cylinder **B** shown in Fig. 7, needs to be attached to the mounting lug on the robot arm so that the cylinder can pivot when tipping the bucket.

Draw on Fig. 7 a bracket that will locate with the  $\text{\O}10$  hole in the mounting lug .

Add a suitable locking device that will prevent the bracket from coming away from the mounting lug during use.

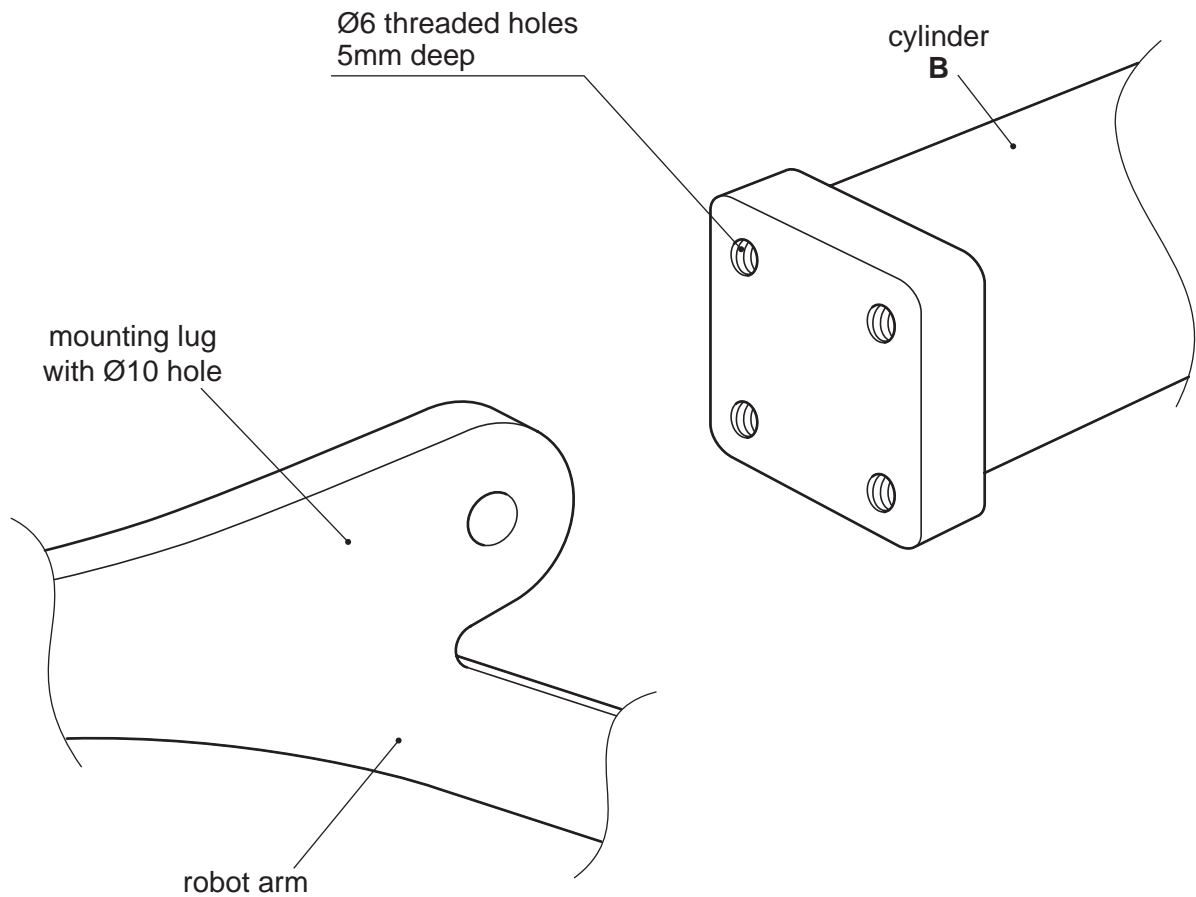


Fig. 7

[5]

**10**  
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