

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY

1957/05

Systems and Control Technology

Paper 5 Pneumatics (Foundation Tier)

Candidates answer on the Question Paper

OCR Supplied Materials:

None

Other Materials Required:

None

Wednesday 26 May 2010

Afternoon

Duration: 1 hour



Candidate
Forename

Candidate
Surname

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

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 **50**.
- Dimensions are in millimetres unless stated otherwise.
- Marks will be awarded for the use of correct conventions.
- This document consists of **12** pages. Any blank pages are indicated.



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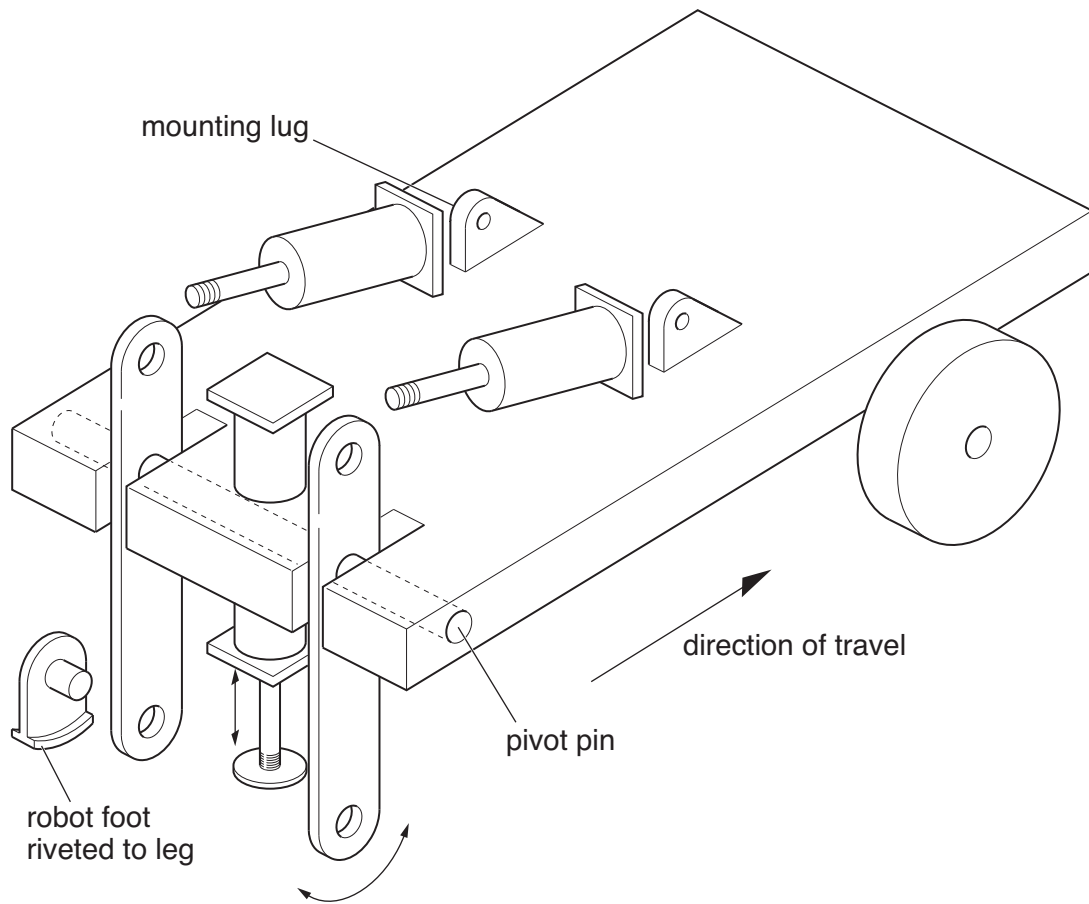


Fig. 1

Fig. 1 shows a pneumatically walking robot.

Movement in the direction of the arrow is achieved by lifting the rear of the robot. The legs are then swung underneath before the robot is lowered. Both legs move out together, propelling the robot forward on its wheels.

- 1 (a) Fig. 2 shows symbols or names of some components used in the walking robot.

Complete Fig. 2 by drawing the missing symbols and adding the missing names.

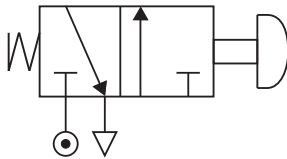
Component Name	Symbol
A Reservoir	[1]
B Air supply	[1]
C Double acting cylinder	[2]
D _____ _____ _____	 [2]
E Shuttle valve	[2]

Fig. 2

- (b) Explain why component **D** in Fig. 2 has a spring.

[Total: 10]

- 2 The test circuit shown in Fig. 3 was used to lift the rear of the robot so that the legs could be moved.

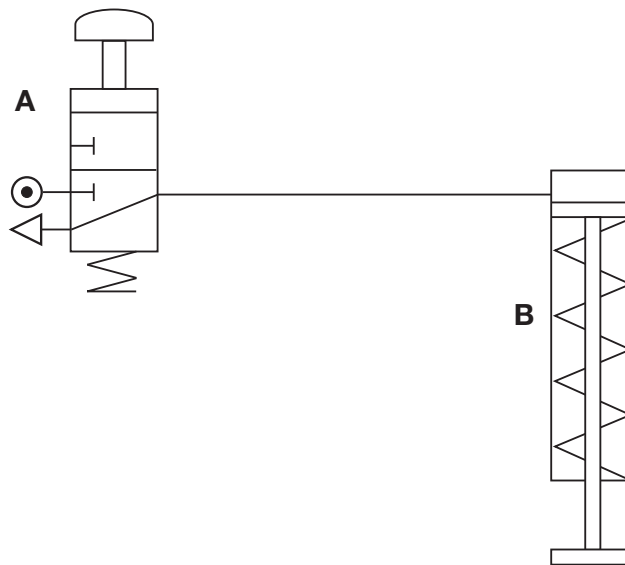


Fig. 3

- (a) Name component **B** in Fig. 3.

_____ [2]

- (b) (i) State what happens when component **A** is pressed and held down.

_____ [1]

- (ii) State what happens when component **A** is then released.

_____ [1]

- (c) The circuit in Fig. 3 operated satisfactorily when lifting the robot, but it lowered too quickly.

- (i) Draw on Fig. 3 a uni-directional flow restrictor that will allow it to lift quickly and lower slowly. [3]

- (ii) Describe how the uni-directional flow restrictor works to allow the rear of the robot to lift quickly and then to lower slowly.

_____ [3]

[Total: 10]

- 3 (a) The compressed air supply on the robot includes an air receiver (reservoir). The receiver is fitted with a safety valve, a drain valve and a pressure regulator with a gauge.

Explain why each component is essential to the **operation** of the system.

(i) Air receiver _____

_____ [2]

(ii) Safety valve _____

_____ [2]

(iii) Drain valve _____

_____ [2]

(iv) Pressure regulator with a gauge _____

_____ [2]

- (b) Explain why it would be important to check the circuit for any unconnected pipes before turning on the main air for the first time after maintenance.

_____ [2]

[Total: 10]

4 Manufacturers of robots use computers to:

- aid the design process;
- test out circuits;
- control pneumatically operated machines during the making of the robot.

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

1 _____ [1]

2 _____ [1]

3 _____ [1]

(b) State **two** reasons why computers are often used to simulate the operation of a pneumatic circuit.

1 _____ [1]

2 _____ [1]

(c) A manufacturing company is considering changing its manually operated machines to computer control.

State **two** possible effects on the workforce.

1 _____ [1]

2 _____ [1]

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

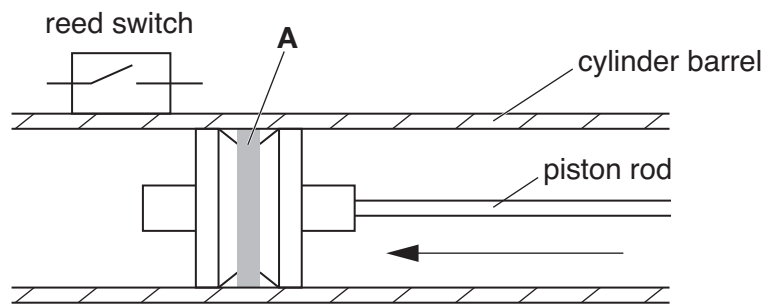


Fig. 4

A reed switch cylinder is an important part of the interface between the pneumatic operation and the computer control of the robotic system.

(d) (i) Name 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]

[Total: 10]

- 5 Fig. 5 shows the top of one leg and the piston rod of an operating cylinder of the walking robot shown in Fig. 1.

The piston rod must be attached to the leg and allow the cylinder to outstroke and instroke to create a walking movement.

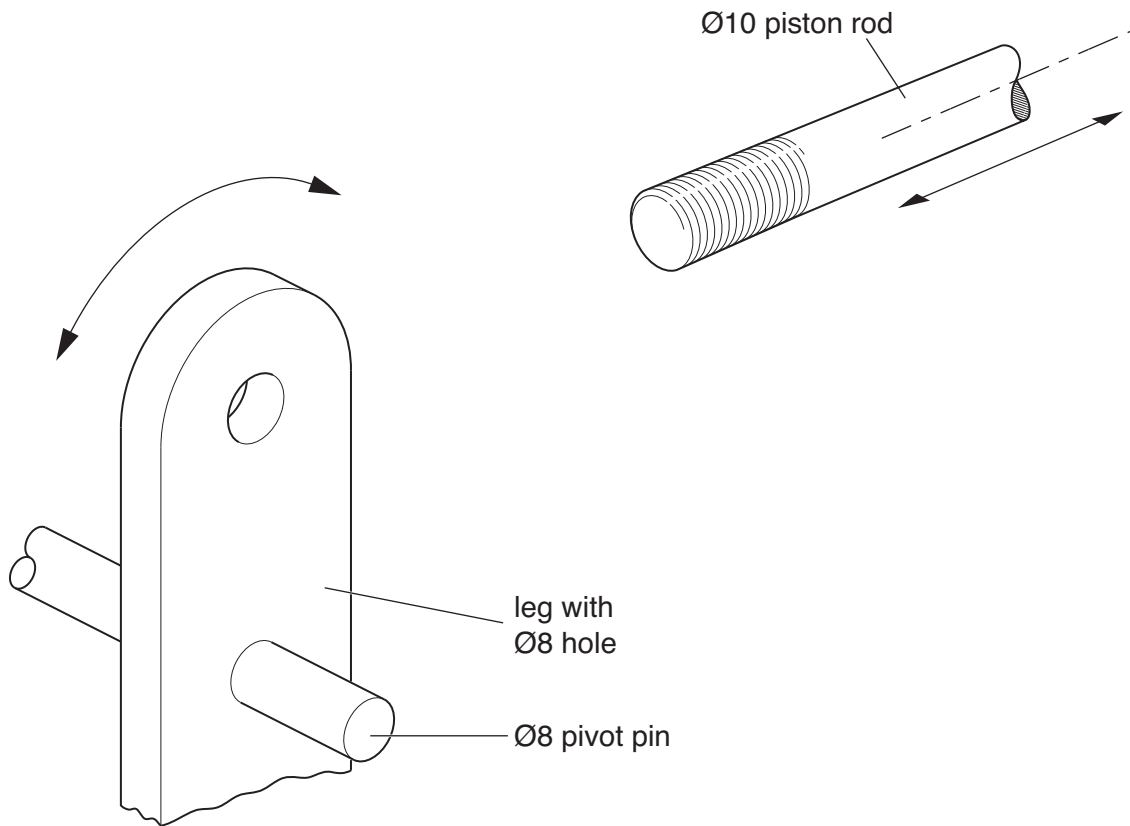


Fig. 5

- (a) Using notes and sketches, complete Fig. 5 to show a component that will fit on the threaded end of the piston rod and attach to the end of the leg allowing the two parts to move as required. [5]

Fig. 6 shows the rear of the cylinder that operates the leg. This cylinder must be attached to the mounting lug on the chassis and allowed to move as shown by the arrow.

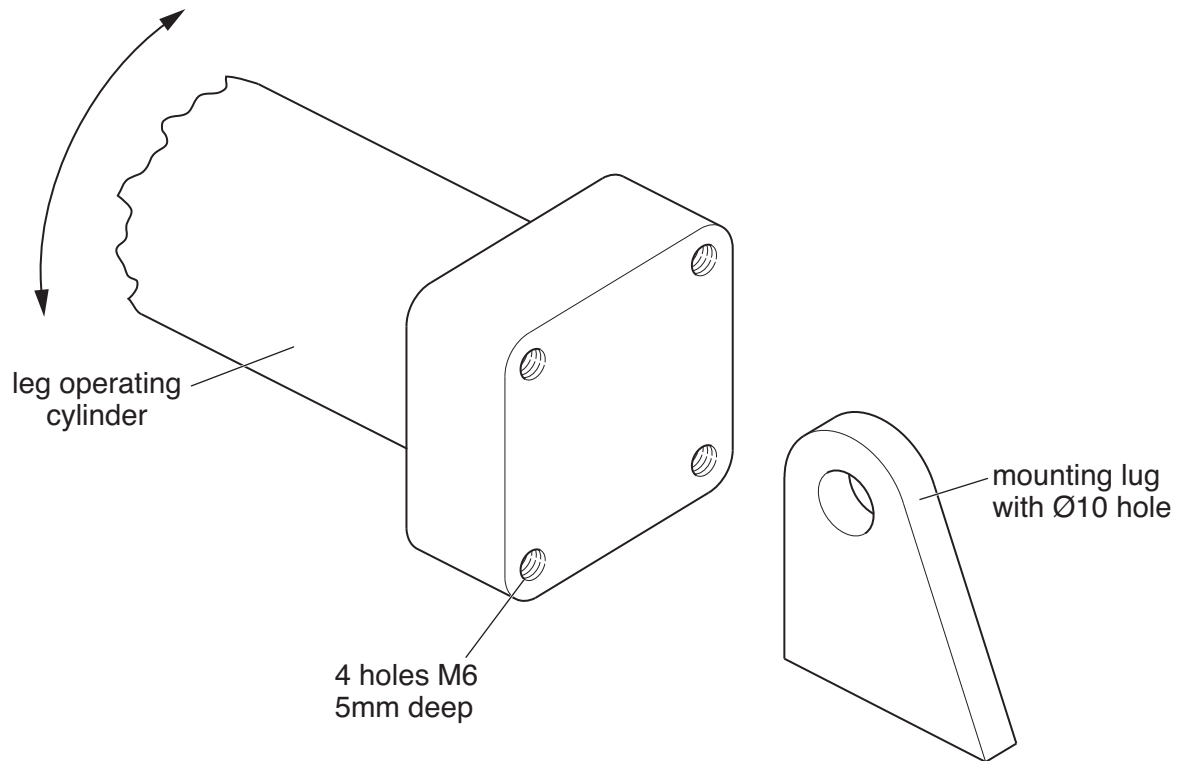


Fig. 6

- (b)** Draw on Fig. 6 a bracket that will secure the cylinder to the mounting lug of the chassis and allow the correct movement of the cylinder. [5]

[Total: 10]

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