

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY

A514/02

Electronics and Control Systems

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

Wednesday 22 June 2011

Morning

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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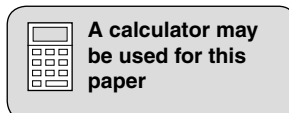
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- 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.
- Answer **all** the questions **in Section A and Section B**.
- 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 is 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 press used to insert skateboard bearings into the wheels.

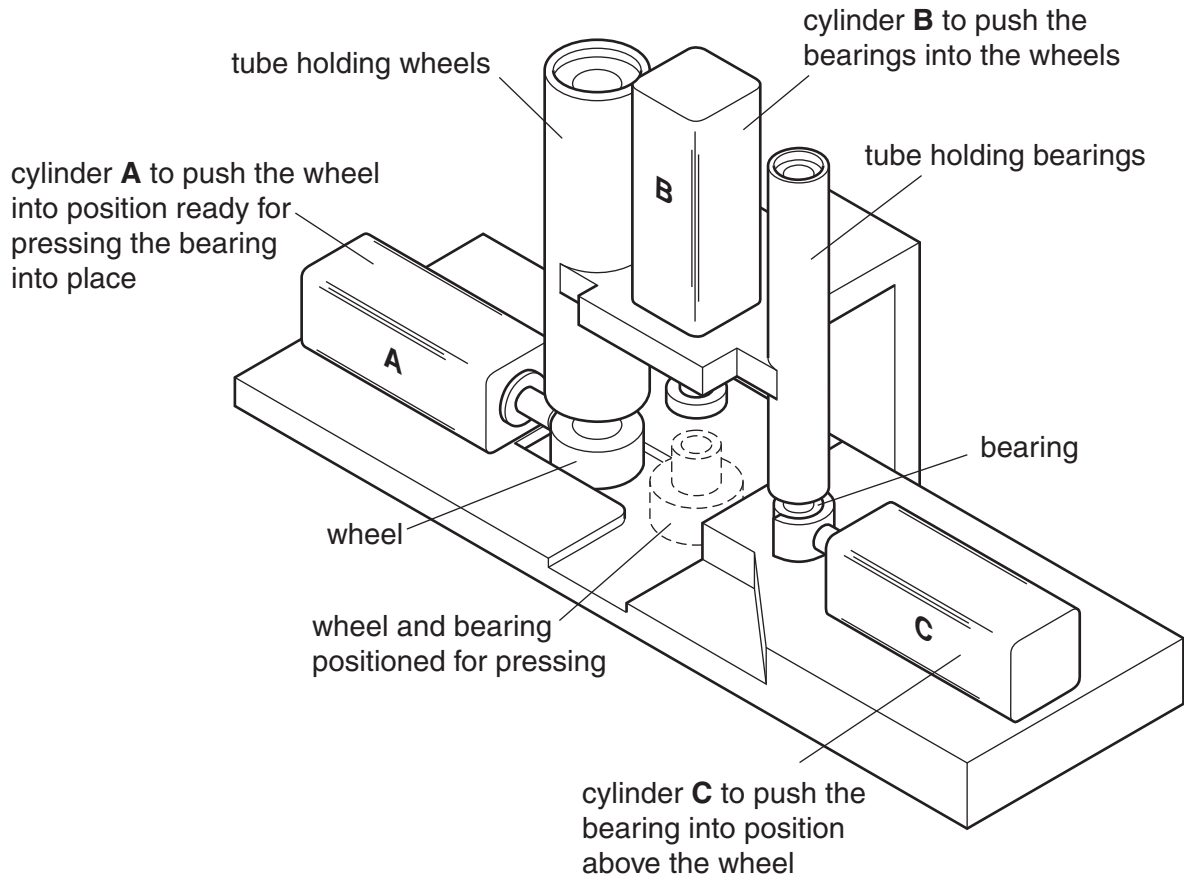

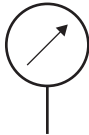
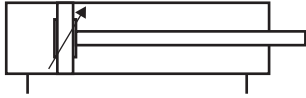



Fig. 1

- (a) The table below shows the name and symbol for some of the components in the pneumatically controlled press shown in Fig. 1. Complete the table by adding the missing names and drawing in the missing symbols. The first one has been done for you.

Component name	Component symbol	
A exhaust		
B		[1]
C bi-directional restrictor		[2]
D		[2]
E		[2]
F foot pedal operated spring return 3/2 valve		[2]

- (b) Explain how the flow of air through a bi-directional restrictor can be adjusted.

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..... [3]

[Total: 12]

2 Fig. 2 shows the pneumatic components for part of the prototype bearing press.

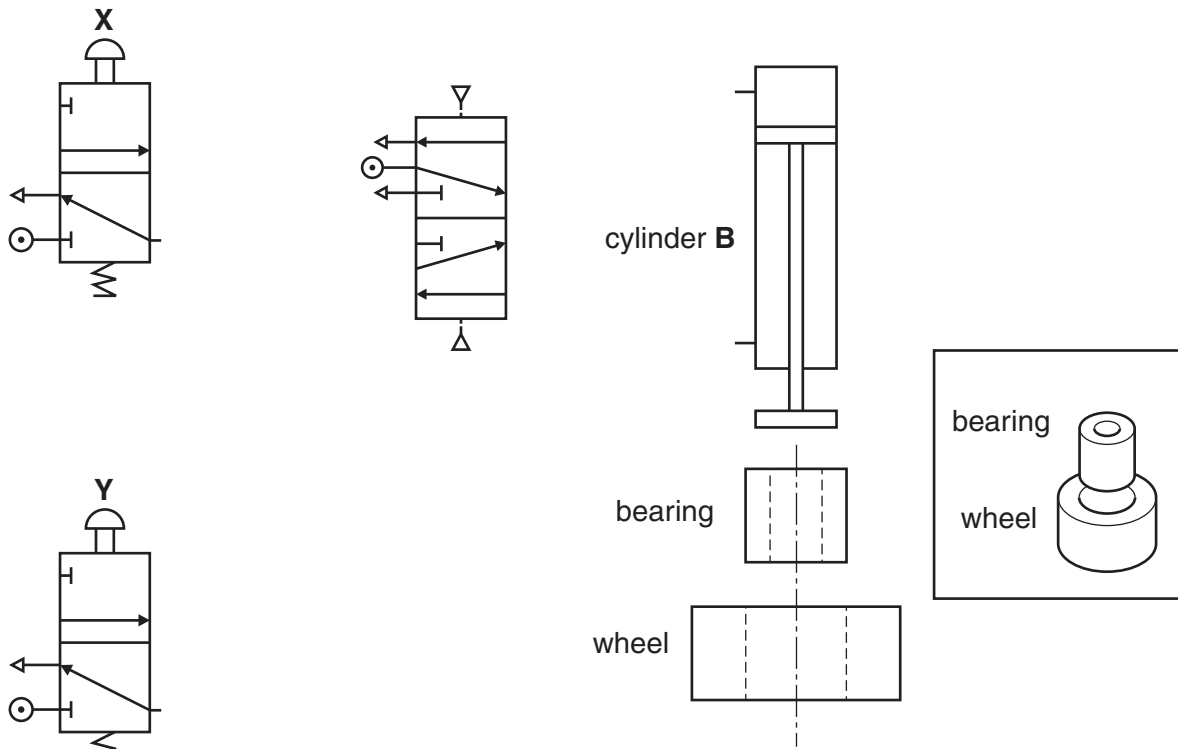


Fig. 2

(a) Draw the connecting lines on Fig. 2 to:

- outstroke cylinder **B**, to press the bearing into the wheel when button **Y** is operated
- instroke the piston rod when button **X** is pressed. [4]

(b) When the circuit in Fig. 2 was tested, the bearing could not be pushed in completely. Give **two** ways by which the problem could be solved.

- 1
-
- 2
- [2]

- (c) Cylinder **B** in Fig. 2 could be replaced with a single acting cylinder. Draw the component symbol for a single acting cylinder.

[2]

- (d) Explain how the circuit in Fig. 2 could be simplified by using a single acting cylinder in place of cylinder **B**.

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[4]

[Total: 12]

3 The process of assembling the bearing and wheel could be automated using CAM systems.

(a) In most automated pneumatic systems the controller needs to know the position of the piston rod. Draw the symbol for a reed switch cylinder which can be used in an automated pneumatic system.

[3]

(b) Explain how the position of the piston rod in a reed switch cylinder can be fed back to the controller.

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Section B

Answer **all** questions.

- 4 Fig. 3 shows the system for pressing the bearings into the wheels.

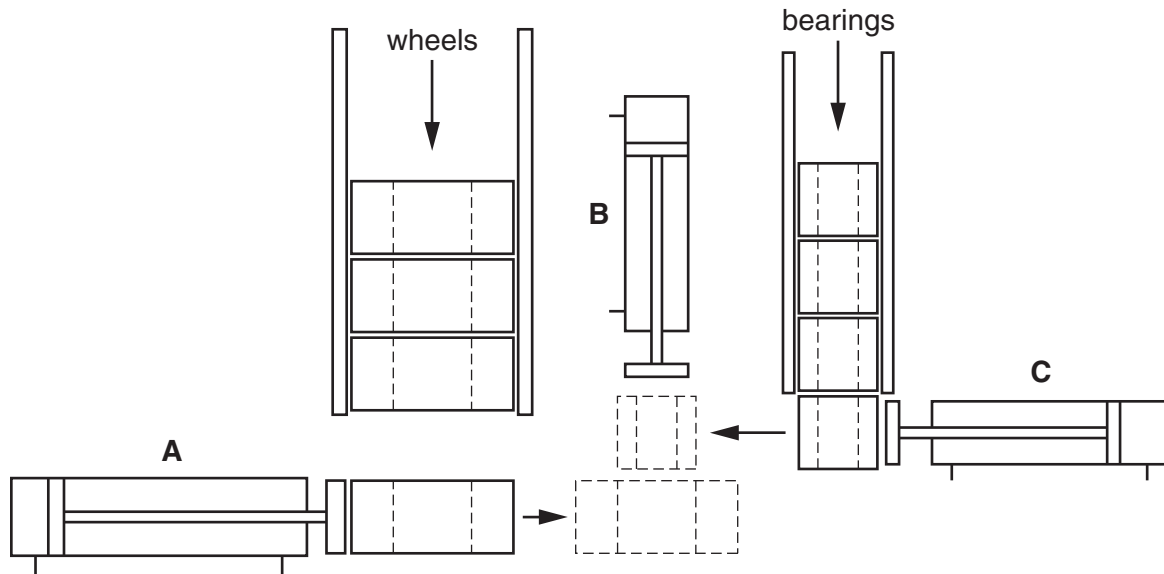


Fig. 3

When the system was first tested it was found that the wheel following the one pushed into place fell on to the outstroked piston rod as shown in Fig. 4. This caused the process to stop working.

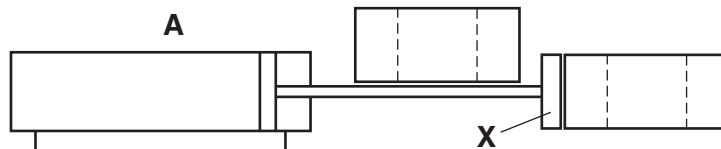


Fig. 4

- (a) Draw a design on Fig. 5 for an attachment that will:
- fit on to the plate labelled **X** on the end of the piston rod.
 - prevent the following wheel dropping on the piston rod
 - include a method of fixing the attachment to component **X**.

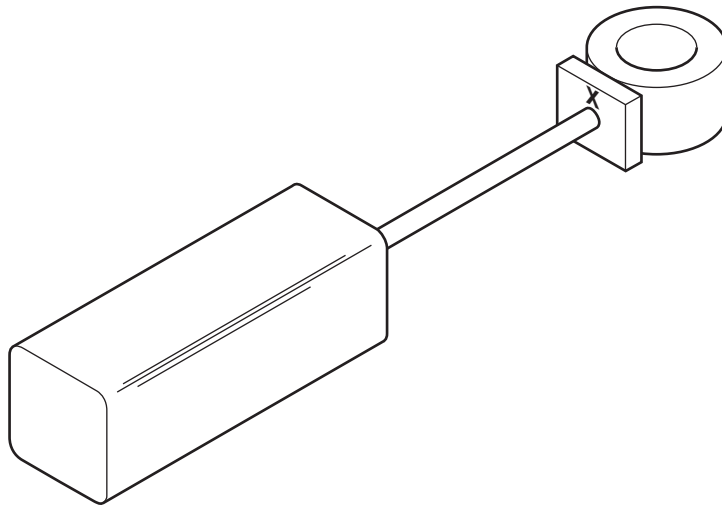


Fig. 5

[6]

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5 Cylinder **B** shown in Fig. 6 provides the force to push the bearing into the wheel.

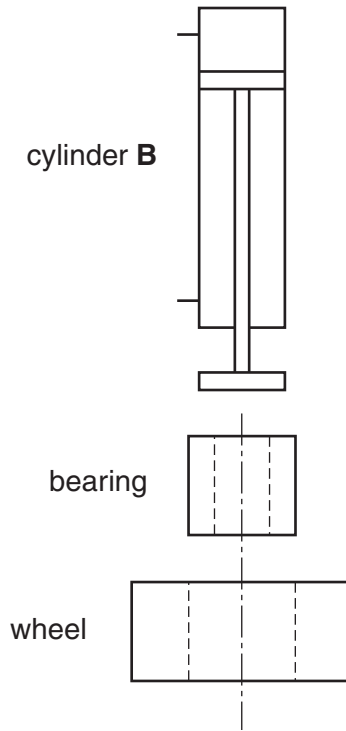


Fig. 6

- (a) The force required to push the bearing into the wheel was found to be 100 N.
 The available cylinder was 30 mm diameter.
 Calculate the minimum air pressure required to push the bearing fully into the wheel.
 Use the formula $F = P \times A$.

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..... [4]

- (b) Cylinders **A**, **B** and **C** must operate in the correct sequence to press the bearings into the wheels.
The system is shown in Fig. 7.

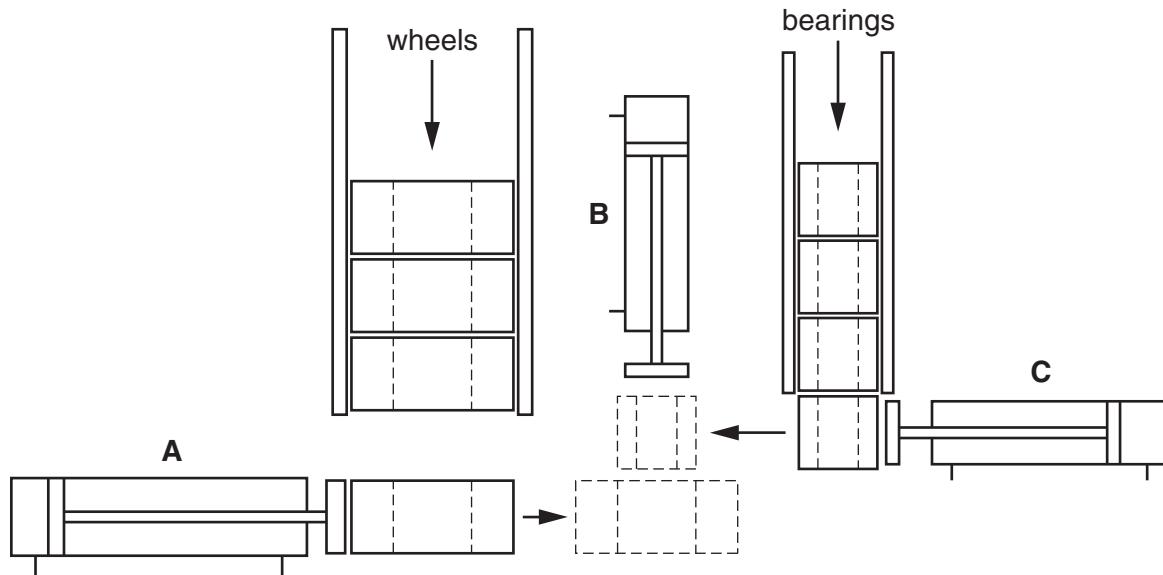


Fig. 7

Using '+' for outstroking and '-' for instroking state the order of operation of cylinders **A**, **B** and **C**.

The sequence starts and ends as shown in Fig. 7.

Cylinders **A** and **C** remain outstroked until the bearing is in place.

The first movement of cylinder **A** is completed.

A+ [5]

- (c) To make the process fully controllable uni-directional restrictors are placed in the circuit of each cylinder.

Explain why using a uni-directional restrictor will make the process faster than using a bi-directional restrictor.

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 [3]

[Total: 12]

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