OCR
RECOGNISING ACHIEVEMENT

GCSE

# Design and Technology

General Certificate of Secondary Education

Unit **A514/ 02** Electronics: Technical Aspects of Designing and Making Pneumatics

# Mark Scheme for June 2011

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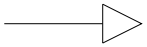
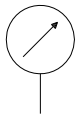
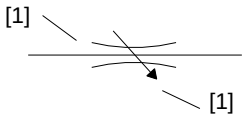
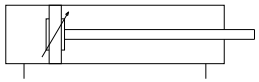
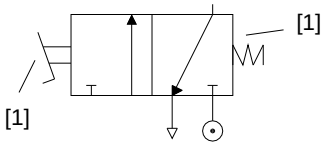
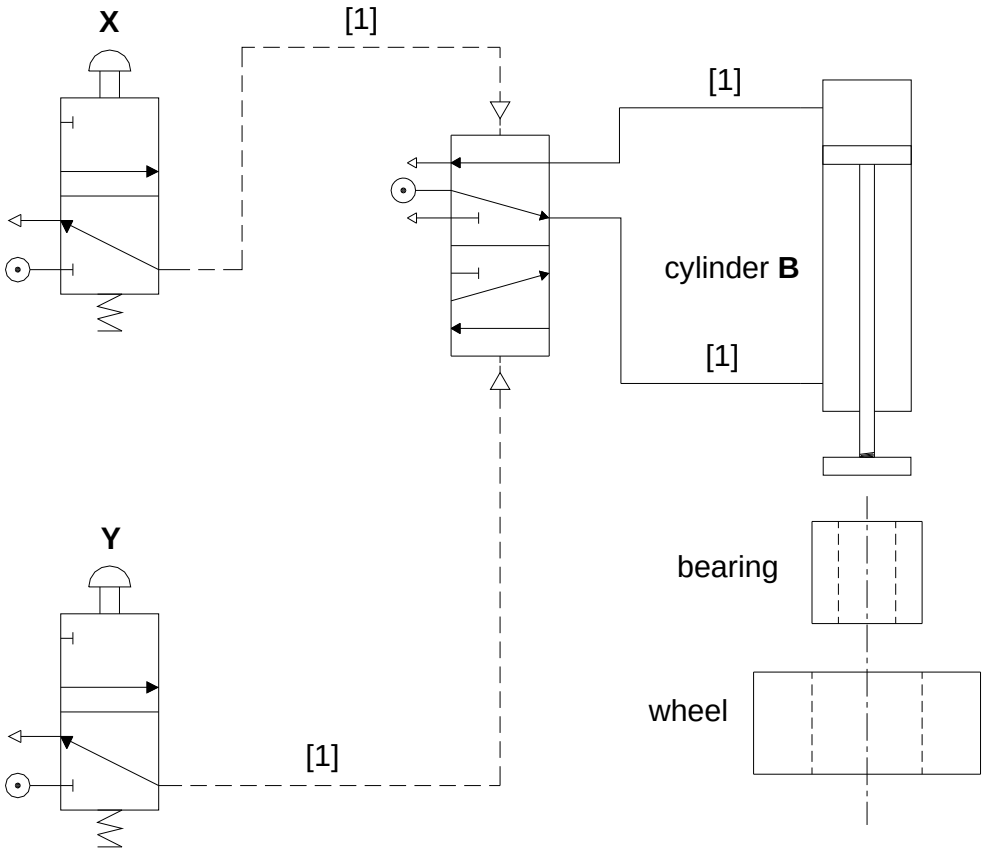
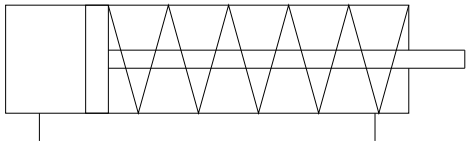
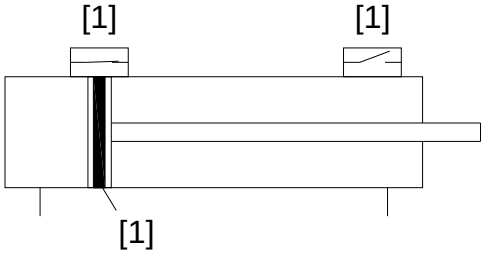
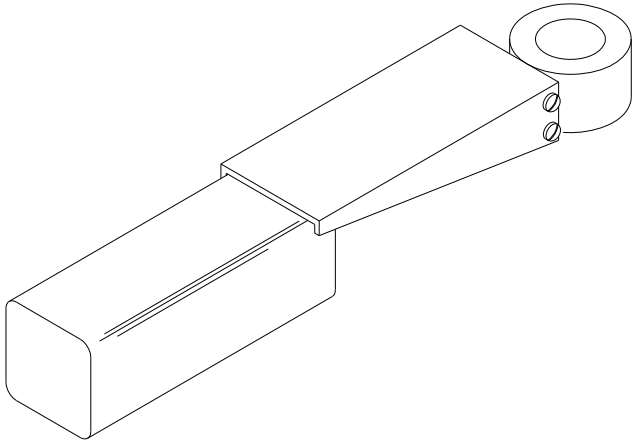
| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| 1 | (a) | | <table><tr><th>Component name</th><th>Component symbol</th></tr><tr><td>A exhaust</td><td>  </td></tr><tr><td>B pressure gauge [1]</td><td>  </td></tr><tr><td>C bi-directional restrictor</td><td>  </td></tr><tr><td>D cushioned [1] double acting cylinder [1]</td><td>  </td></tr><tr><td>E push button [1] valve [1]</td><td>  </td></tr><tr><td>F foot pedal operated spring return 3/2 valve</td><td>  </td></tr></table> | [1]<br>[2]<br>[2]<br>[2]<br>[2] | |
| | | | The air flow through a bi-directional restrictor can be adjusted by tightening [1] or loosening [1] a bolt which closes down the airflow [1]. | [3] | |
| | | | **TOTAL** | [12] | |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| 2 | (a) | | 1 mark for each correct connection.<br>  <br> | **[4]** | |
| | **(b)** | | To produce more force to press the bearing fully in;<br>either the pressure can be increased [1]<br>or a larger cylinder could be used [1]. | **[2]** | Allow increase area. |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| 2 | (c) | | Cylinder drawn correctly [1]<br>Return spring shown [1].<br>  | [2] | |
| | | | If cylinder B was replaced by a single acting cylinder the circuit could be simplified because:<br>the return of the cylinder (instroke) would be caused by the spring expanding [1].<br>This would mean that there would need to be only one push button [1].<br>This would mean that there would be no need for the 5/2 valve [1].<br>Less air consumption as the spring provides the instroke force [1]. | [4] | |
| | | | **TOTAL** | **[12]** | |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| 3 | (a) | | Reed switch above piston closed [1]<br>Reed switch at other end open [1]<br>Magnet indicated [1].<br>  <br> | [3] | |
| | (b) | | The piston has a magnetic ring fixed to it [1].<br>There are two reed switches attached to the ends of the cylinder [1].<br>When the piston and magnet is near the switches they close and send a signal to the processor [1]. | [3] | For reed switch accept switch, if drawn correctly in 3(a). |
| | (c*) | | Discussion could include the following points:<br>• There are fewer employees required for automated production than manual production<br>• This can lead to unemployment<br>• Fewer, more skilled employees, are required to maintain automation<br>• The initial costs of setting up and developing automation is high<br>• The running cost of automatic processes is lower than manual processes<br>• Employees who are sick take more time to recover than fixing a machine<br>• Productivity increases<br>• Machines can work 24/7<br>• Machines take no holidays.<br>• Consistent quality of output.<br>Allow marks for other suitable reasons.<br><br>**Level 1 (0-2marks)**<br>Shows limited understanding of the issues involved when automating processes.<br>There will be little or no use of specialist terms.<br>Answers may be ambiguous or disorganised.<br>Errors of grammar, punctuation and spelling may be intrusive. | [6] | |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| | | | **Level 2 (3-4 marks)**<br>Shows some understanding of the issues involved when automating processes with some analysis of the issues involved.<br>There will be some use of specialist terms although theses may not always be used appropriately.<br>The information will be presented for the most part in a structured format.<br>There may be occasional errors in spelling, punctuation and grammar.<br><br>**Level 3 (5-6 marks)**<br>Shows detailed understanding of the issues involved when automating processes and analyses most of the issues involved.<br>Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar. | | |
| | | | **TOTAL** | **[12]** | |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| 4 | (a) | |  <br>One possible answer<br><br>Shaped to fit plate at **X** [1] Lateral guides to cylinder [1]<br>Fixing at X shown [1] Wheel prevented from dropping [1]<br>Overlap to cylinder top [1] Piston can instroke under wheel [1] | **[6]** | |
| | **(b*)** | | Discussion could include the following points:<br>• incorporation of a safety valve is in the design of pneumatic circuits<br>• check connections are secure<br>• make sure all components are fixed down<br>• Check pressure is set correctly<br>• Cylinders positioned to prevent fouling when outstroking<br>• When applying pressure for the first time, open the supply slowly<br>• Do not let air pressure get to the skin<br>• Keep fingers clear of moving parts<br>• If circuit does not work, turn off the pressure and check the connections and layout.<br>Allow marks for other suitable reasons.<br><br>**Level 1 (0-2marks)**<br>Shows limited understanding of the H&S issues involved.<br>There will be little or no use of specialist terms. | **[6]** | |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| | | | Answers may be ambiguous or disorganised.<br>Errors of grammar, punctuation and spelling may be intrusive.<br><br>**Level 2 (3-4 marks)**<br>Shows some understanding of the H&S issues involved with some analysis of the issues involved.<br>There will be some use of specialist terms although theses may not always be used appropriately.<br>The information will be presented for the most part in a structured format.<br>There may be occasional errors in spelling, punctuation and grammar.<br><br>**Level 3 (5-6 marks)**<br>Shows detailed understanding of the H&S issues involved and analyses most of the issues involved.<br>Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar. | | |
| | | | **TOTAL** | **[12]** | |

| Question | | | Expected Answer | Marks | Rationale |
|---|---|---|---|---|---|
| 5 | (a) | | Use the formula F = P x A<br><br>F = P x A<br><br>100 = P x ($\pi$ x $15^2$) [1]<br><br>$P = \frac{100}{\pi \times 15 \times 15}$ [1]<br><br>$P = \frac{100}{707}$ [1]<br><br>P = 0.14N/$mm^2$ [1] | [4] | Correct answer with no working give 4 marks. |
| | (b) | | A + C+ B+ B – C – A– **or** end with any combination of A- B- C-<br>[1] [1] [1] [1] [1] | [5] | |
| | (c) | | A bi-directional restrictor will restrict the air in both directions causing the instroke to be slowed down as well as the outstroke [1].<br><br>A uni-directional restrictor will allow free flow in one direction allowing the instroke to return quickly [1].<br><br>The instroke is just returning the piston to the start position and so there is no need to slow it down; this will speed up the process if it returns quickly [1]. | [3] | |
| | | | **TOTAL** | [12] | |

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