Examples for pneumatic circuit design using Cascade Method

1 November, 2005

Q4 October 2003 Examination

a) In both the Cascade and the Lucas methods of designing purely pneumatic sequencing circuits, one of the rules in dividing the sequence states that no letter should be repeated in any group. Briefly explain what you think is the purpose of this rule.

(3 marks)

b) In an automatic material processing machine, the following sequence of operations involving four pneumatic cylinders (A, B, C and D) is required. The cycle of operation is to begin from the rest position each time a START pushbutton is actuated.

START A+ (delay) B+ C+ D+ C- D-B- A-

The time delay between the end of the A+ stroke and the start of the B+ stroke is to be adjustable.

Design a purely pneumatic circuit to achieve the above sequence of operations. You may use any approach in developing a workable design, but credit will be given to that which employs the least number of pneumatic components.

(*Note:* You may draw your pneumatic circuit on the sheet provided which has the symbols of four pneumatic cylinders.)

(18 marks)

c) To cater for emergency stops for the machine in (b) above, two manually-operated emergency stop valves, ESTOP1 and ESTOP2, are to be provided such that when either one is actuated, any pneumatic cylinder in motion come to an immediate stop. A CONTINUE manually-operated valve is to be provided such that when this is actuated, the sequence will continue from where it stops.

Design the additional pneumatic circuit needed and show how you will add it to your circuit in (b) to achieve this. (4 marks)

<u>Solution</u> 4a) The rule is to avoid conflicting signals, when high pressure is present, at both end of the control valve.



4c)



Q3 October 2000 Examination

The sequence of operations in a printing machine is to be automated using three pneumatic cylinders, **A**, **B** and **C**. A **START** pushbutton is to initiate each sequence of operations but the sequence will only begin if an incoming part is present, as indicated by the actuation of a limit valve **LV**. Once initiated, the cylinders move according to the following

A+ B+ (DELAY) B- C+ B+ (DELAY) B- C-

Each of the time delays before the two **B**- motions in the sequence needs to be individually adjustable.

- (a) Design a purely pneumatic control circuit to achieve the sequence of operations as described above. (You may provide your answer on the template of three cylinders provided.) (20 marks)
- (b) Show how you would modify your pneumatic circuit to provide the following additional features:

Two additional pushbuttons, SINGLE and AUTO, are to be provided such that

- i) Actuation of **AUTO** at any time will place the system in the automatic mode of operation. In this mode of operation, after a sequence of operation has been completed, a new sequence will be automatically initiated as long as an incoming part is present, as detected by **LV**.
- ii) Actuation of **SINGLE** at any time will place the system in the single-cycle mode of operation. In this mode, any on-going sequence will continue until it is completed. The system will then rest in that position until **START** is again pressed to initiate a new sequence.

(5 marks)

Solution to Q3(b)

Change the START PB and the LV limit valve to the following circuit_



ME3242 Nov 2000 - Solution to Q3 (a)

