

LEVEL 4 ASSESSMENT SPECIFICATION

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Programme:	HNC/D MECHANICAL ENGINEERING HNC/D ELECTRICAL & ELECTRONIC ENGINEERING		
Module:	Engineering Applications & Study Skills		
Module code:	GOEN4000	Contribution to Overall Module Assessment (%):	60%
Lecturer:	C. Williams	Internal Verifier:	R. Kadhim
Assignment Title:	Designing and simulating pneumatic circuits for process control.	Word count (or equivalent):	1000
Submission deadline:	8/05/2025	Return date of provisional marks & written feedback:	22/05/2025
Submission method:	All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.) Alternative submission method (if applicable):		

	Late submission of the assessment will result in a late penalty mark. Penalties for late submission: Up to one-week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.
Academic honesty / referencing:	Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.

Engineering Applications and study skills

Design And Simulation of Pneumatic Design.

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Task 1

In a production setting, a double acting cylinder with stroke length of 250mm has to raise a load of up an inclined surface of 30 degrees. Tests at the production centre have measured that the coefficient of static friction is 0.19 and the coefficient of sliding friction is 0.13. The operating pressure of the production compressed air supply is a maximum of 0.7 Mpa. An operator uses a normally closed 3/2 push button switch to raise the load which they hold until the load is dispatched. The button is then released allowing the cylinder to retract.

Calculating the force required to move the load.

- 1) Static friction

$$F_{static} = \mu_{static} \times m \times g \times \cos(30) \rightarrow F = 0.19 \times 100 \times 9.81 \times \cos(30) = 161.42N$$

- 2) Sliding friction

$$F_{sliding} = \mu_{sliding} \times m \times g \times \cos(30) \rightarrow F_{sliding} = 0.13 \times 100 \times 9.81 \times \cos(30) \\ = 110.44N$$

- 3) Figure out the Weight of the load

$$F = m \times g \rightarrow F = 100 \times 9.81 = 981N$$

- 4) Figure out the Force to overcome Gravity.

$$F_g = F \times \sin(30) \rightarrow F_g = 981 \times 0.5 = 490.5N$$

- 5) Figure out the friction force

$$F_f = F \times \cos(30) \rightarrow F_f = 981 \times \cos(30) = 849.3N$$

- 6) Figure out the Total Required Force.

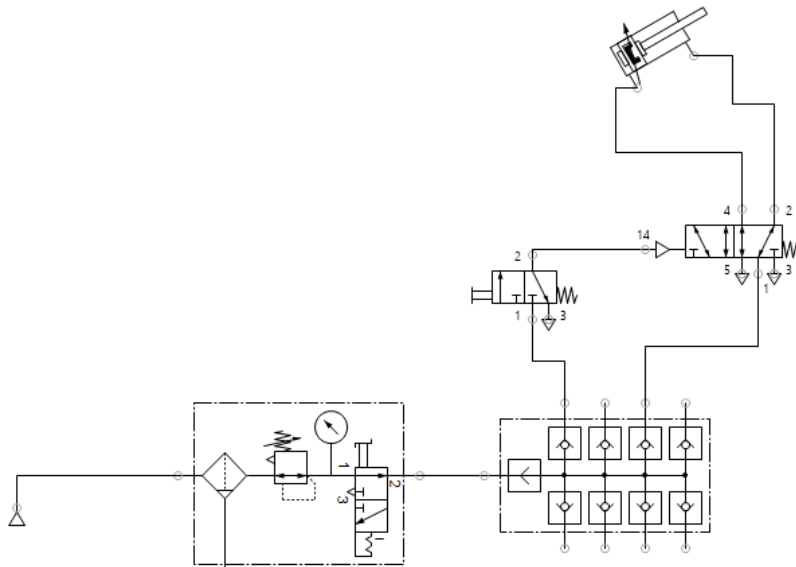
$$F_R = F_g + F_{static} \rightarrow F_R = 490.5 + 161.42 = 651.92N$$

Suitable Cylinder Requirements



- Wide range of variants for customized applications
 - Good running performance and long service life
- Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes
 - Piston rod with female or male thread

Design the circuit and using Fluid Sim.

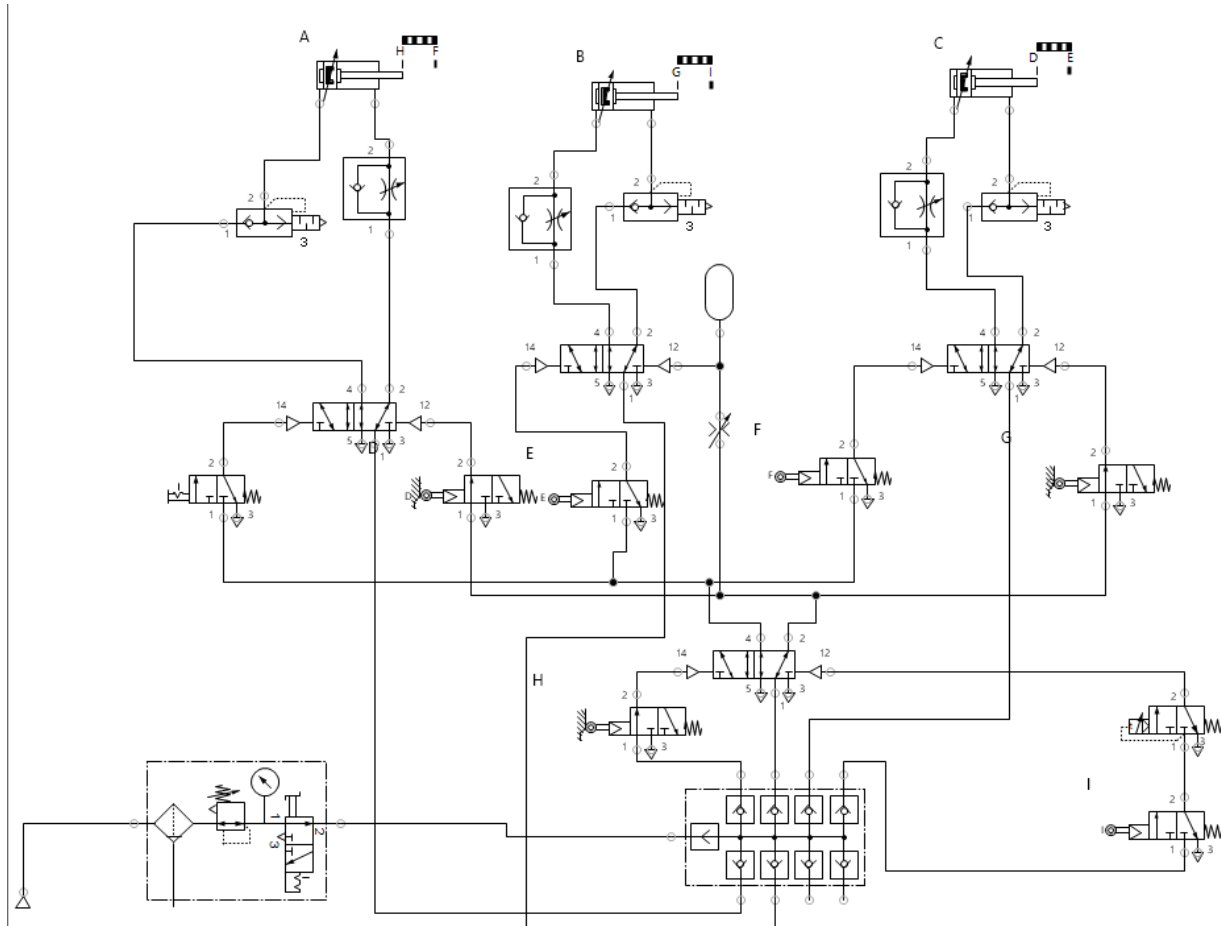


Components in the circuit.

- Double-Acting is a pneumatic or hydraulic device that exerts force in both directions.
- 5/2 valve directs airflow into one port of the cylinder and exhausts from the other.

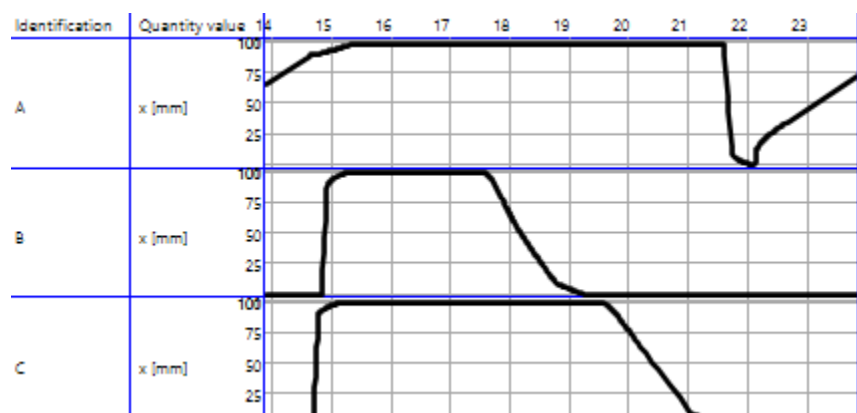
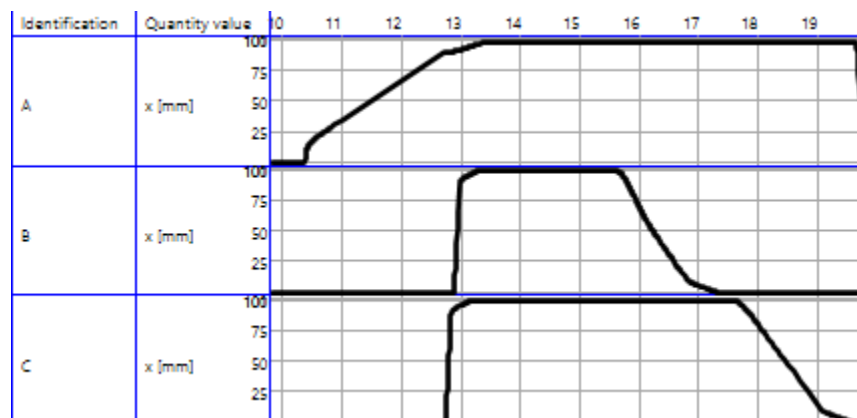
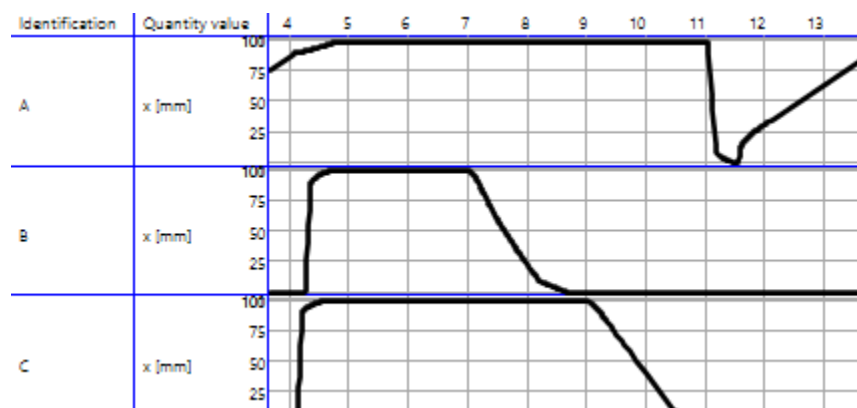
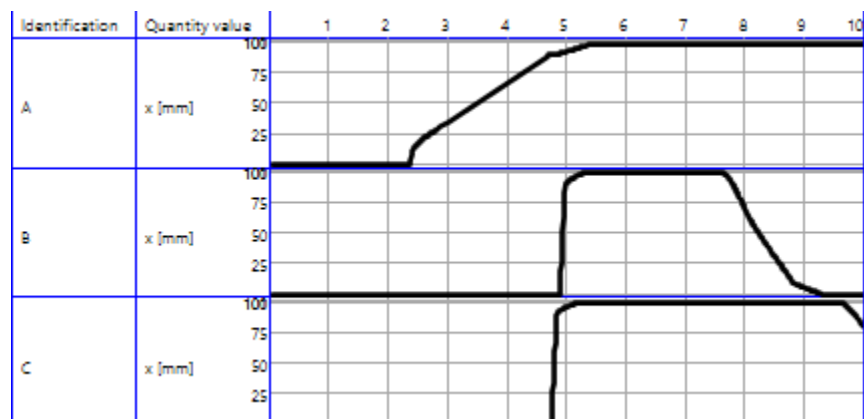
Task 2

Circuit design



How the system works

Extension (extraction) and retraction (return) are the two main stages of operation for the regulated double-piston system. Compressed air passes through a throttle valve during the extension phase, limiting airflow to guarantee the primary piston moves slowly and deliberately. A secondary piston could help stabilize or direct the motion in the interim. A quick exhaust valve (QEV) quickly releases air from the piston's return side when the system transitions to the retraction phase, enabling a quick and effective reset. In automated applications like presses or material handling systems, the combination of quick exhaust for retraction and throttle control for extension guarantees a smooth, accurate forward stroke followed by a quick return, maximizing both speed and control.



Because it offers a visual depiction of the system's performance and makes evident the relationship between speed, location, and time during both the extension and retraction phases, the time graph that shows the piston's movement is crucial. The graph assists engineers in analyzing cycle efficiency, detecting delays, and optimizing throttle and exhaust valve settings by charting the displacement of the piston with time.