Rewarding Learning

General Certificate of Secondary Education
2014

Technology and Design

Unit 2: Systems and Control
Element 2: Mechanical and Pneumatic Control Systems

[GTD22]

TUESDAY 3 JUNE, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses. The mark schemes should be read in conjunction with these general marking instructions.

Assessment objectives

Below are the assessment objectives for GCSE Technology and Design.

Students must:

- recall, select and communicate their knowledge and understanding of technology and design in a range of contexts (AO1);
- apply skills, knowledge and understanding, in a variety of contexts and in designing and making products (AO2); and
- analyse and evaluate products, including their design and production (AO3).

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of an unanticipated answer, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive Marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response
Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the "best-fit" bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

- ***Threshold Performance*:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.

- ***Intermediate Performance*:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.

- ***High Performance*:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Marking calculations
In marking answers involving calculations, examiners should apply the "own figure rule" so that candidates are not penalised more than once for a computational error.

Quality of written communication
Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is limited.
Level 2: Quality of written communication is satisfactory.
Level 3: Quality of written communication is very good.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level 1 (Limited): The level of accuracy of presentation, spelling, punctuation and grammar is limited. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary.

Level 2 (Satisfactory): The level of accuracy of presentation, spelling, punctuation and grammar is satisfactory. The candidate makes a satisfactory selection and use of an appropriate form and style of writing supported with appropriate use of diagrams as required. Relevant material is organised with some clarity and coherence. There is some use of specialist vocabulary.

Level 3 (Very Good): The level of accuracy of presentation, spelling, punctuation and grammar is very good. The candidate successfully selects and uses the most appropriate form and style of writing, supported with precise and accurate use of diagrams where appropriate. Organisation of relevant material is very good. There is very good use of appropriate specialist vocabulary.

AVAILABLE MARKS

1 **(a)** **(i)** Double acting cylinder or DAC [1]

(ii) 5 port valve or 5/2 valve [1]

(iii) Pilot air or signal air [1]

(iv) Press button C [1]

(v) Valve E [1]

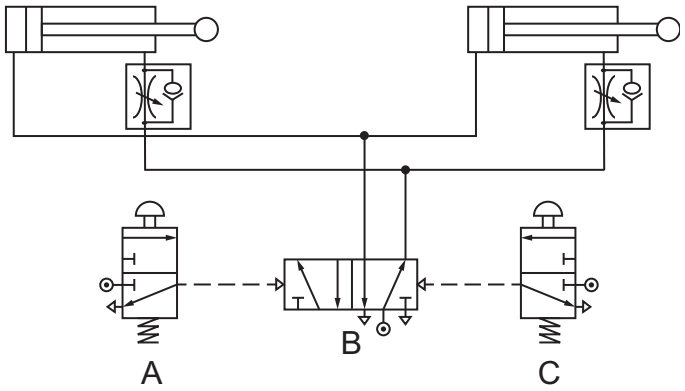
(b) **(i)** Reservoir [1]

(ii) Press C, valve B switches, cylinder A outstrokes [2]
At same time air flows to restrictor and reservoir [2]
After set time delay valve B resets and A instrokes [2]

(iii) Parts released automatically after set time. [2]

(iv) Increase cylinder diameter or increase pressure [2]
Adjust the flow restrictor or fit larger reservoir [2]

(c) **(i)** Connection from supply to front of each cylinder
(2 × [1]) [2]
Back of each cylinder connected to exhaust
(2 × [1]) [2]
One way flow restrictor correctly fitted to exhaust of **each cylinder** on outstroke
(2 × [2]) [4]

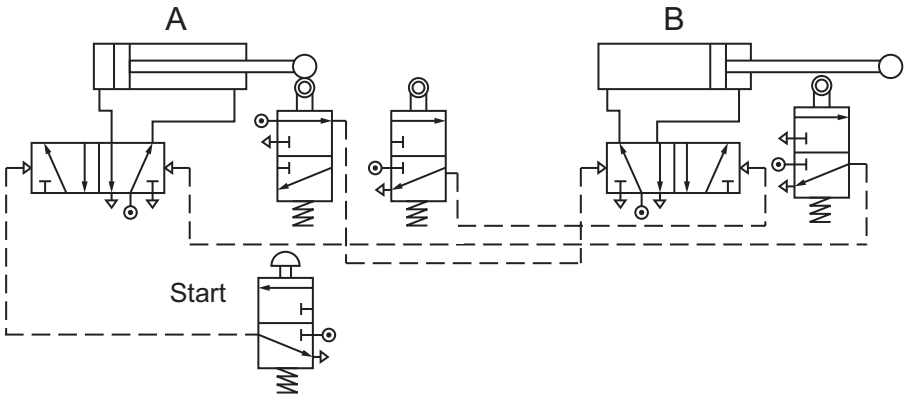


(ii) $F = P \times A$
$600 = 0.6 \times A$ [1]
$A = 1000\ mm^2$ [1]
Area of each cylinder = $500mm^2$ [1]

AVAILABLE MARKS

(d) **(i)** Connection from :

Start to 5/2 valve cylinder A [2]
3/2 valve at A+ to 5/2 valve B to give B– [2]
3/2 valve at B– to 5/2 valve A to give A– [2]
3/2 valve at A– to 5/2 valve B to give B+ [2]



(ii) Fit 3/2 valve at B+ [1]
Connect to the supply port of start valve [1]
Change start valve to button operated button reset [1]

40

2 **(a)**

Name	Letter
Sprockets and chain	C
Toothed belt	A
Simple gear train	D
Compound gear train	B

[8]

(b) **(i)** Linear [1]

(ii) Bell crank lever or First Class lever [2]

(iii) CM = ACM about B [1]

$F \times 180 = 600 \times 60$ [1]

$F = \frac{600 \times 60}{180}$ [1]

$= 200N$ [1]

(c) **(i)** A Roller [1]
B Flat [1]
C Knife [1]

(ii) Least friction: roller [1]
Complex shapes: knife [1]

(iii) Eccentric [1]

(iv) Fall $20 - 5 = 15$ [1]
$= 15 - 5$ [1]
$= 10$ [1]

				AVAILABLE MARKS
(d)	**(i)**	Rack and pinion	[2]	
	(ii)	Distance moved by Effort		
		Effort distance = circumference		
		= π × 200	[2]	
		= 628 mm	[2]	
		The Velocity Ratio		
		1 Turn of handle		
		Rack pinion turns $\frac{15}{45}$ revs	[2]	
		Rack pinion turns through $\frac{15 \times 18}{45}$ teeth		
		= 6 teeth	[2]	
		Table movement = 6 × 5		
		= 30 mm	[2]	
		Velocity ratio = $\frac{\text{Effort distance}}{\text{Load distance}}$		
		= $\frac{628}{30}$		
		= 20.9	[2]	
	(iii)	It will reduce the distance moved by the table	[2]	40
			Total	**80**