



*Rewarding Learning*

**General Certificate of Secondary Education  
2023**

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**Engineering and Manufacturing**

Unit 2

*assessing*  
Production

**[GEM21]**

**TUESDAY 9 MAY, MORNING**

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**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 likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these general marking instructions.

### **Assessment Objectives**

Below are the assessment objectives for GCSE Engineering and Manufacturing.

Candidates must:

- AO1** Recall, select and communicate their knowledge and understanding of engineering and manufacturing in a range of contexts;
- AO2** Apply skills, knowledge and understanding, including quality standards in a variety of design contexts. Plan and carry out investigations and making tasks involving an appropriate range of tools, equipment, materials and processes; and
- AO3** Analyse and evaluate evidence, design proposals and outcomes, make reasoned judgements and present conclusions and recommendations.

### **Quality of candidates' responses**

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

### **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 unanticipated answers, 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.

**Part 1 Bright mild steel flat**

**1 6 off 5 mm diameter holes**

**(i) Hole locations**

Holes correctly located within a tolerance of  $\pm 0.5$  mm (6  $\times$  [2])

Holes correctly located within a tolerance of  $\pm 1.5$  mm (6  $\times$  [1])

Outside tolerance of  $\pm 1.5$  mm [0]

(6  $\times$  [2])

[12]

**(ii) 6  $\times$  5 mm diameter holes**

Hole diameters 5 mm [1]

Hole diameters incorrect [0]

(1  $\times$  [1])

[1]

13

**2 1 off M5 threaded hole**

**(i) Hole location**

Hole correctly located within a tolerance of  $\pm 0.5$  mm (1  $\times$  [2])

Hole correctly located within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])

Outside tolerance of  $\pm 1.5$  mm [0]

(1  $\times$  [2])

[2]

**(ii) Fit of a threaded bar into the threaded hole**

Threaded bar fits closely in the hole [2]

Threaded bar loose/tight fit in the hole [1]

Threads do not engage [0]

(1  $\times$  [2])

[2]

**(iii) Squareness of the threaded hole**

Threaded bar less than  $2^\circ$  out of square [2]

Threaded bar more than  $2^\circ$  out of square [1]

Threads do not engage [0]

(1  $\times$  [2])

[2]

6

**AVAILABLE  
MARKS**

### 3 6 off linear dimensions

AVAILABLE  
MARKS

**(i) Linear dimension (40 mm)**

Within a tolerance of  $\pm 0.5$  mm (1 × [3])  
Within a tolerance of  $\pm 1$  mm (1 × [2])  
Within a tolerance of  $\pm 1.5$  mm (1 × [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1 × [3])

[3]

**(ii) Linear dimension (20 mm)**

Within a tolerance of  $\pm 0.5$  mm (1 × [3])  
Within a tolerance of  $\pm 1$  mm (1 × [2])  
Within a tolerance of  $\pm 1.5$  mm (1 × [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1 × [3])

[3]

**(iii) Linear dimension (20 mm)**

Within a tolerance of  $\pm 0.5$  mm (1 × [3])  
Within a tolerance of  $\pm 1$  mm (1 × [2])  
Within a tolerance of  $\pm 1.5$  mm (1 × [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1 × [3])

[3]

**(iv) Linear dimension (15 mm)**

Within a tolerance of  $\pm 0.5$  mm (1 × [3])  
Within a tolerance of  $\pm 1$  mm (1 × [2])  
Within a tolerance of  $\pm 1.5$  mm (1 × [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1 × [3])

[3]

**(v) Linear dimension (18 mm)**

Within a tolerance of  $\pm 0.5$  mm (1 × [3])  
Within a tolerance of  $\pm 1$  mm (1 × [2])  
Within a tolerance of  $\pm 1.5$  mm (1 × [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1 × [3])

[3]

**(vi) Linear dimension (35 mm)**

Within a tolerance of  $\pm 0.5$  mm (1 × [3])  
Within a tolerance of  $\pm 1$  mm (1 × [2])  
Within a tolerance of  $\pm 1.5$  mm (1 × [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1 × [3])

[3]

18

### 4 Quality of finish

**(i)** Good quality of finish on the bright mild steel flat edges [2]  
Satisfactory quality of finish on the bright mild steel flat edges [1]  
Edges unfinished [0]  
(1 × [2])

[2]

**(ii)** Good quality of finish on the bright mild steel flat faces [2]  
Satisfactory quality of finish on the bright mild steel flat faces [1]  
Faces unfinished [0]  
(1 × [2])

[2]

4

**Part 2 Acrylic Part**

**AVAILABLE  
MARKS**

**5 2 off 6 mm diameter holes**

**(i) Hole location on short tab**

Hole correctly located within a tolerance of  $\pm 0.5$  mm (1  $\times$  [2])

Hole correctly located within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])

If outside tolerance of  $\pm 1.5$  mm [0]

(1  $\times$  [2])

[2]

**(ii) Hole location on long tab**

Hole correctly located within a tolerance of  $\pm 0.5$  mm (1  $\times$  [2])

Hole correctly located within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])

If outside tolerance of  $\pm 1.5$  mm [0]

(1  $\times$  [2])

[2]

**(iii) Hole Diameters**

Hole diameters 6 mm [1]

Hole diameters incorrect [0]

(1  $\times$  [1])

[1]

**(iv) 1 off 3 mm diameter hole on base of part**

Hole correctly located within a tolerance of  $\pm 0.5$  mm (1  $\times$  [2])

Hole correctly located within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])

Outside tolerance of  $\pm 1.5$  mm [0]

(1  $\times$  [2])

[2]

**(v) Hole Diameter**

Hole diameter 3 mm [1]

Hole diameter incorrect [0]

(1  $\times$  [1])

[1]

8

**6 6 off linear dimensions**

**AVAILABLE  
MARKS**

**(i) Linear dimension (35 mm)**

Within a tolerance of  $\pm 0.5$  mm (1  $\times$  [3])  
Within a tolerance of  $\pm 1$  mm (1  $\times$  [2])  
Within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1  $\times$  [3])

[3]

**(ii) Linear dimension (25 mm)**

Within a tolerance of  $\pm 0.5$  mm (1  $\times$  [3])  
Within a tolerance of  $\pm 1$  mm (1  $\times$  [2])  
Within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1  $\times$  [3])

[3]

**(iii) Linear dimension (25 mm)**

Within a tolerance of  $\pm 0.5$  mm (1  $\times$  [3])  
Within a tolerance of  $\pm 1$  mm (1  $\times$  [2])  
Within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1  $\times$  [3])

[3]

**(iv) Linear dimension (40 mm)**

Within a tolerance of  $\pm 0.5$  mm (1  $\times$  [3])  
Within a tolerance of  $\pm 1$  mm (1  $\times$  [2])  
Within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1  $\times$  [3])

[3]

**(v) Linear dimension (50 mm)**

Within a tolerance of  $\pm 0.5$  mm (1  $\times$  [3])  
Within a tolerance of  $\pm 1$  mm (1  $\times$  [2])  
Within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1  $\times$  [3])

[3]

**(vi) Linear dimension (30 mm)**

Within a tolerance of  $\pm 0.5$  mm (1  $\times$  [3])  
Within a tolerance of  $\pm 1$  mm (1  $\times$  [2])  
Within a tolerance of  $\pm 1.5$  mm (1  $\times$  [1])  
Outside a tolerance of  $\pm 1.5$  mm [0]  
(1  $\times$  [3])

[3]

18

		AVAILABLE MARKS
<b>7 Bent part</b>		
<b>(i) Width from cutout to LH side (10 mm)</b>		
Within a tolerance of $\pm 0.5$ mm (1 × [3])		
Within a tolerance of $\pm 1$ mm (1 × [2])		
Within a tolerance of $\pm 2$ mm (1 × [1])		
Outside a tolerance of $\pm 2$ mm [0]		
(1 × [3])	[3]	
<b>(ii) Width from cutout to RH side (10 mm)</b>		
Within a tolerance of $\pm 0.5$ mm (1 × [3])		
Within a tolerance of $\pm 1$ mm (1 × [2])		
Within a tolerance of $\pm 2$ mm (1 × [1])		
Outside a tolerance of $\pm 2$ mm [0]		
(1 × [3])	[3]	
<b>(iii) Height from base to LHS cutout (20 mm)</b>		
Within a tolerance of $\pm 0.5$ mm (1 × [3])		
Within a tolerance of $\pm 1$ mm (1 × [2])		
Within a tolerance of $\pm 2$ mm (1 × [1])		
Outside a tolerance of $\pm 2$ mm [0]		
(1 × [3])	[3]	
<b>(iv) Height from base to RHS cutout (20 mm)</b>		
Within a tolerance of $\pm 0.5$ mm (1 × [3])		
Within a tolerance of $\pm 1$ mm (1 × [2])		
Within a tolerance of $\pm 2$ mm (1 × [1])		
Outside a tolerance of $\pm 2$ mm [0]		
(1 × [3])	[3]	12
<b>8 10 mm Radii</b>		
Radii completed to a high degree of precision (4 × [3])		
Radii completed to a satisfactory degree of precision (4 × [2])		
Radii completed to a poor degree of precision (4 × [1])		
Radii not present [0]		
(4 × [3])	[12]	12
<b>9 Sides bent square to the base</b>		
Sides square to the base within $1^\circ$ (2 × [3])		
Sides square to the base within $2^\circ$ (2 × [2])		
Sides square to the base within $3^\circ$ (2 × [1])		
Sides outside a tolerance of $3^\circ$ [0]		
(2 × [3])	[6]	6
<b>10 Quality of finish</b>		
Good wet and dry paper finish on all of the acrylic part edges [3]		
Satisfactory quality finish with some tool marks on the acrylic part edges [2]		
Poor quality finish some saw and cross filing marks on the edges [1]		
Unfinished on most of the edges [0]		
(1 × [3])	[3]	3
	<b>Total</b>	<b>100</b>