T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

Metrology Sciences

Assignment 3 - Pass

Guide standard exemplification materials

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T Level Technical Qualification in Science
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Metrology Sciences

Assignment 3

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Introduction

The material within this document relates to the Metrology Sciences occupational specialism sample assessment. These exemplification materials are designed to give providers and students an indication of what would be expected for the lowest level of attainment required to achieve a pass or distinction grade.

The examiner commentary is provided to detail the judgements examiners will undertake when examining the student work. This is not intended to replace the information within the qualification specification and providers must refer to this for the content.

In assignment 3, the student must correct a technical drawing, produce an inspection cost per part and write a plan to measure the produced part.

After each live assessment series, authentic student evidence will be published with examiner commentary across the range of achievement.

Task 1: customer drawing query

Scenario

You have been contacted by a potential customer who has supplied a drawing and asked you to provide a quote for producing the parts. You have noticed faults and missing information with the drawing provided.

Task

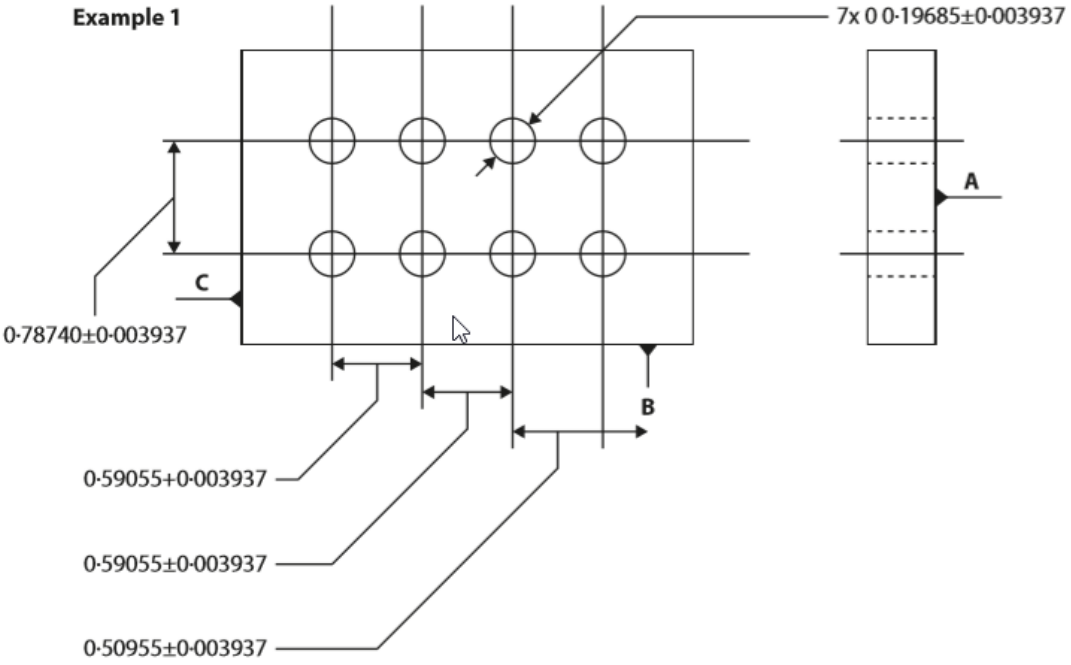
Complete the diagram key so the customer understands the information on the diagram,

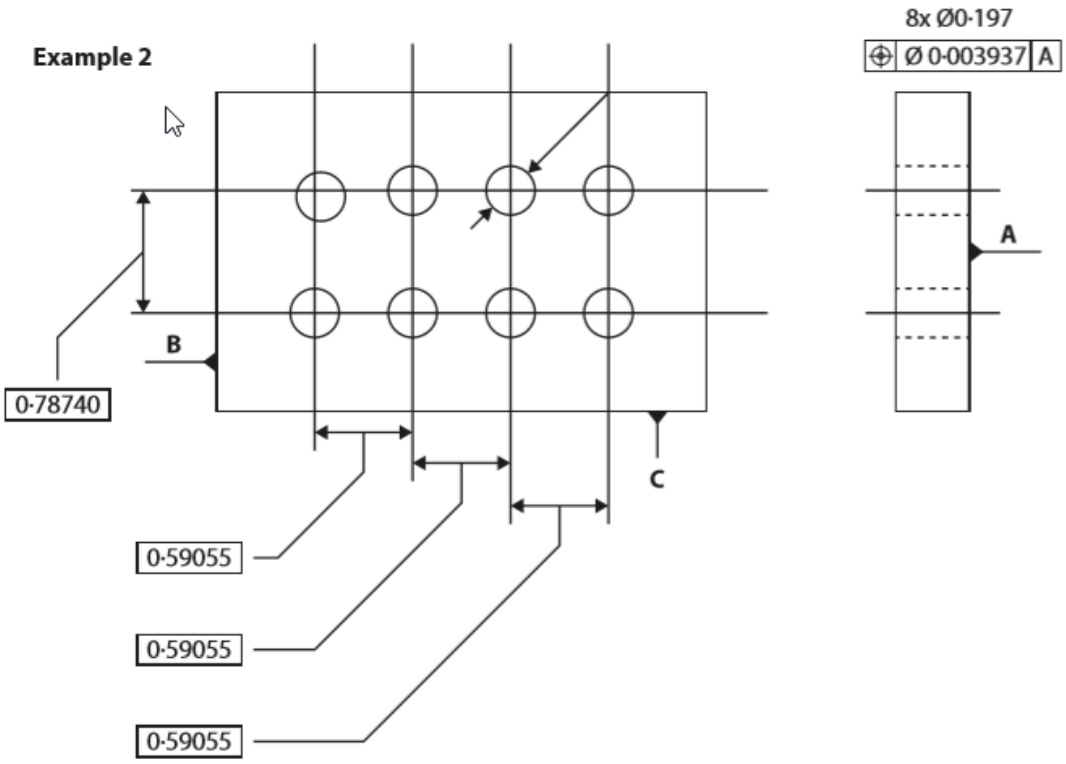
and

Correct any incorrect or missing information in the drawings provided by the customer.

Symbol	Geometric characteristic	Tolerance type
	Straightness	
	Angularity	
		Location
	Total Runout	Runout
		Location
	Perpendicularity	
	Profile of a surface	Location
	Cylindricity	Form
		Form

All measurements in cm unless otherwise stated.


Example 1
7x 0 0·19685±0·003937
A
C
0·78740±0·003937
B
0·59055+0·003937
0·59055±0·003937
0·50955±0·003937


Example 2
8x Ø0·197
Ø 0·003937 A
A
B
0·78740
C
0·59055
0·59055
0·59055

Student evidence

Symbol	Geometric characteristic	Tolerance type
	Straightness	Form
	Angularity	Orientation
		Location
	Total Runout	Runout
	True Position	Location
	Perpendicularity	
	Profile of a surface	Location
	Cylindricity	Form
	Flatness	Form

Issues with the diagrams:

Example 1: only showing 7 circular holes not 8 on the leader dimension.

One of the dimension terminates beyond the hole centre line, but still has the same distance as the other hole positions.

Example 2: one of the arrows isn’t finished. One of the circles isn’t drawn properly.

B and C labels are different

Task 2: calculating inspection cost

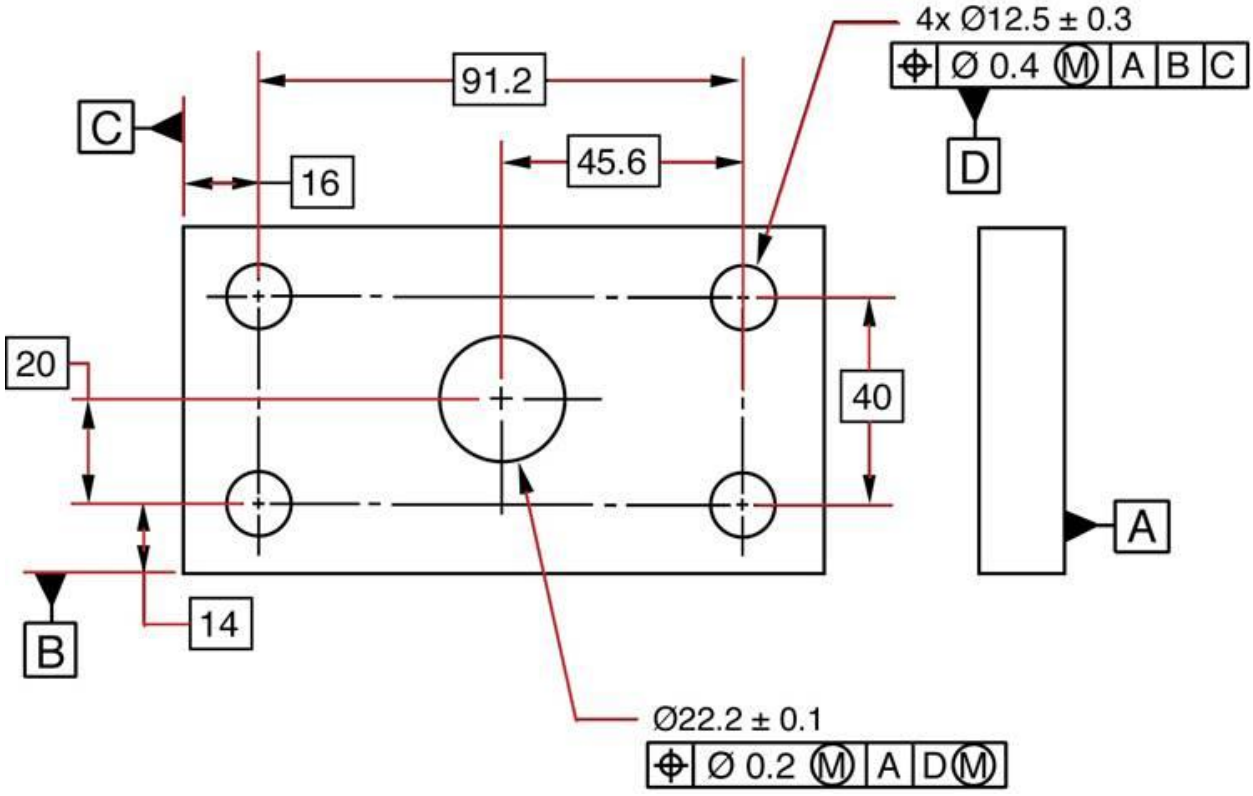
Scenario

The sales department for Precision Engineers has received an enquiry from AirRow Parts Ltd to inspect machined components from supplied die casting parts. As part of your role, you have been asked to produce an estimate for the inspection of these parts, based on the customer requirements and drawing provided.

Task

Produce a cost per product, and a total cost for an inspection of a batch of 100 units. A template has been provided to support you. If you wish, you may make your own template, as long as it meets the needs of the task

The estimate should include each key feature in the drawing and should show the equipment required, with reference to any uncertainty associated with the equipment.



All measurements in centimetres unless otherwise stated.

Student evidence

Task 2 template - inspection cost template

Number	Ref location	Characteristic designator	Requirement	Unit	Upper limit	Lower limit	Equipment and preparation required	Accuracy/uncertainty consideration	Estimation of prep time	Estimation of number of measurements	Estimation of time per measurement	Total time
40		Distance between holes	40	mm	0.05	0.05	Steel ruler. Steel ruler to be cleaned so that scale can be read	Holding the end of the steel ruler at the centre of the hole will be difficult	3 minutes	3	1 minutes	6 minutes
14		Distance from an edge to a hole	14	mm	0.05	0.05	Steel ruler. Steel ruler to be cleaned so that scale can be read	Holding the end of the steel ruler at the centre of the hole will be difficult	3 minutes	3	1 minutes	6 minutes
12.5		Diameter of holes	12.5	mm	0.05	0.05	Steel ruler. Steel ruler to be cleaned so that scale can be read	Holding the steel ruler at the edge of the hole will be difficult	3 minutes	3 per hole	1 minutes	18 minutes
							Total		9 minutes	18	3 minutes	30 minutes

Rate at £110/hr	
Total time	**30 mins**
Time per part	
Total cost	
Cost per part	**£55**

Any additional notes not displayed in quote table:

Task 3: designing a plan for inspection

Scenario

Your estimation for the inspection of the 100 parts has been accepted and you have been provided with all 100 parts, based on the customer requirements. Before you inspect them, you need to create an inspection procedure and define how the parts will be measured. The procedure shall highlight any issue which may occur with repeatability.

Task

Use the drawing of the part from task 2 to create working instructions detailing your plan. Your plan should include:

- how you will inspect every critical feature
- your sampling method to ensure all aspects are recorded
- the data collection method selected
- creation of a suitable uncertainty budget
- how you will ensure calibration of equipment selected
- appropriate tooling and equipment selection, with justification, taking consideration of the relative uncertainty of measurement of the equipment selected for each measurement
- how you will ensure environmental factors are dealt with
- how you will be minimising the impact of hazards and complying with relevant health and safety, law and legislation

Any other relevant inclusions.

Student evidence

Inspecting all 100 parts will take a long time so my plan will help to speed this up.

I will use a steel ruler to measure everything on the drawing (the lengths and holes).

When measuring the distance between the holes I will put the ruler so that the end of it is in line with the middle of the hole and read the value on the ruler where the centre of the other hole is. When measuring the distance between the hole and an edge I will put the ruler so that the end of it is in line with the middle of the hole and read the value on the ruler where the edge is. Doing this will be difficult so there will be some errors. Holding the ruler at the edge of the hole will be difficult so I will try my best to keep it still.

I will measure once and write this down. Measuring once will save time.

I will need to be careful as the steel ruler is sharp so it may cut me. Therefore, so that I don’t get cut, I will be very careful when using the ruler and I will not walk around when holding it.

I might be uncertain about the measurement if I can’t read it properly. If the part is dirty, then I may not be able to see the edges very well so to stop this from happening I will clean the part first. I will make sure that I wear my glasses so that I can see the ruler properly. Also, I will make sure that the room is not dark so that I am able to read the result from the ruler.

To reduce the uncertainty in the equipment used, I would make sure that it has an up to date calibration certificate. Also, I would ensure that the temperature of the workshop was stable. This is because the size of the material will change very slightly with changes in temperature due to thermal expansion of the material. To prevent this, I will make sure that the air conditioning in the workshop is set to 20 degrees and that no windows are opened.

Distance between 2 holes	The ruler should be used to measure between the outer edge of each hole, as well as the radius. The radius of each hole will then need to be measured and added on.
Distance between a hole and an edge	In order to accurately make this measurement, the ruler should be used to measure between the inner edge of the hole and the edge of the part. The radius of the hole will then need to be measured and added on.
Diameter of a hole	Rear jaws on vernier callipers used to measure the internal diameter of the holes. Care to be taken to make sure that the verniers are measuring the hole diameter and not an edge of the hole. Also, the diameter of the hole may not be consistent so multiple readings at different angles around the hole should be taken.

Examiner commentary

The student has correctly labelled almost all the key geometric characteristics, providing details on missing symbols, names and tolerance types. There are only a few minor omissions/errors.

The student has highlighted the key issues with the example technical drawings, including highlighting incorrect leader information, incorrect dimension termination, missing leader line, incorrect hole position and inconsistent labelling of datums B and C. The student has suitably corrected these issues on the drawings provided.

In task 2, the student has estimated the cost for the 3 key features. The student has selected a suitable piece of equipment to complete the inspection and considered the time required for any preparation before inspection and measurement has been undertaken.

The student has considered the uncertainty for each measurement and although this is basic, the considerations are suitable. The student has provided a realistic estimation of time and number of measurements required and has made some accurate but basic calculations to find the total cost or cost per part.

The student has completed a basic plan that outlines some of the key equipment planned to be used and explains the requirements of the task. The student has considered the equipment used for different parts of the component to be measured, and this is evident in the plan.

There is basic consideration of how to mitigate environmental factors included in the plan.

Overall grade descriptors

The performance outcomes form the basis of the overall grading descriptors for pass and distinction grades.

These grading descriptors have been developed to reflect the appropriate level of demand for students of other level 3 qualifications, the threshold competence requirements of the role and have been validated with employers within the sector to describe achievement appropriate to the role.

Occupational specialism overall grade descriptors:

Grade	Demonstration of attainment
Pass	The evidence is logical but displays minimal knowledge of basic metrological content in response to the demands of the brief.
	The student makes some use of relevant knowledge and understanding of how metrology informs practices in many sectors and demonstrates a limited understanding of perspectives or approaches associated with basic measurement tasks and principles.
	The student makes adequate use of facts/theories/approaches/concepts and attempts to demonstrate breadth and depth of metrological knowledge and understanding.
	The student is able to identify some metrological information from appropriate sources and makes use of appropriate information/appraise relevancy of information and can combine information to make decisions.
	The student makes minimal judgements/takes appropriate action/seeks clarification with metrological sources of guidance and is able to make limited progress towards solving non-routine problems in real life measurement activities/situations.
	The student attempts to demonstrate metrological skills and knowledge of the relevant concepts and techniques reflected in a measurement services role and generally applies this across different contexts and measurement skill sets.
	The student shows adequate understanding of unstructured measurement-related problems that have not been seen before, using limited knowledge to find solutions to problems and make justification for strategies for solving problems, explaining their reasoning.
Distinction	The metrological evidence is precise, logical and provides a detailed and informative response to the measurement related demands of the brief.
	The student makes extensive use of relevant knowledge and understanding of how metrology informs practices in many sectors and demonstrates an understanding of perspectives or approaches associated with basic measurement tasks and principles.

	The student makes decisive use of facts/theories/approaches/ demonstrating extensive breadth and depth of metrological knowledge, understanding and selects highly appropriate skills/techniques/methods.
	The student is able to comprehensively identify metrological information from a range of suitable sources and makes exceptional use of appropriate information/appraise relevancy of information and can combine information to make coherent measurement decisions.
	The student makes well founded judgements/takes appropriate action/seeks clarification with metrological sources of guidance and is able to use that to reflect on real life measurement activities/situations.
	The student demonstrates extensive metrological skills and knowledge of the relevant concepts and techniques reflected in a measurement services role and precisely applies this across a variety of contexts and tackles unstructured problems that have not been seen before, using their knowledge and measurement skill sets to analyse and find suitable solutions to the measurement problems.
	The student can thoroughly examine metrological data/information in context and apply appropriate analysis in confirming or refuting conclusions and carrying out further work to justify strategies for solving problems, giving concise explanations for their reasoning.

Task 2 template - inspection cost template

Number	Ref location	Characteristic designator	Requirement	Unit	Upper limit	Lower limit	Equipment and preparation required	Accuracy/uncertainty consideration	Estimation of prep time	Estimation of number of measurements	Estimation of time per measurement	Total time
							Total					

Rate at £110/hr	

Total time	
Time per part	
Total cost	
Cost per part	

Any additional notes not displayed in quote table:

Document information

The T Level Technical Qualification is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.

Owner: Head of Assessment Design

Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Published final version.		June 2021
v1.1	NCFE rebrand		September 2021