**NZQA**

**Approved**

Achievement standard: 91055 Version 3

Standard title: Demonstrate understanding of basic concepts used in manufacturing

Level: 1

Credits: 4

Resource title: Manufacturing an electronic product

Resource reference: Generic Technology VP-1.12 v2

Vocational pathway: Manufacturing and Technology

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| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-91055-02-7372 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

Achievement standard: 91055

Standard title: Demonstrate understanding of basic concepts used in manufacturing

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Resource title: Manufacturing an electronic product

Resource reference: Generic Technology VP-1.12 v2

Vocational pathway: Manufacturing and Technology

Learner instructions

# Introduction

This assessment activity requires you to demonstrate your understanding of basic concepts used in the manufacturing of an electronic product.

You are going to be assessed on how comprehensive your understanding is of basic concepts used in the manufacturing of an electronic product.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

Compare two different electronic product manufacturing processes and two categories of electronic product manufacturing techniques used in New Zealand, and explain why these different techniques are used to manufacture an electronic product. You need to show that you are able to process and interpret information and prepare a presentation that includes:

* the types of manufacturing systems used
* why the manufacturing systems are used in a manufacturing process
* how they determine yield
* how quality control is managed
* why these mechanisms may be affected by social and environmental change.

## Investigate

The following investigation is to ensure that you present relevant information.

Find out about how two different types of electronic products are manufactured through different manufacturing systems and techniques (see Resources A and C).

Gather information about the techniques used for inspection, transport, storage, and operation in at least two different electronic product manufacturing processes (see Resources B and C).

In particular, find out about:

* the operations used in a range of electronic product manufacturing processes and the resources required for these operations
* the order in which the operations are carried out in different processes, and the reasons for this order (you could use flow diagrams to record this information)
* the quality control that is applied during the processing, when it is applied, and how it informs the processing (for example, by providing information to help with the next step or providing guidance on changes that need to be made to ensure that the end product has the required qualities)
* the safety procedures that should be followed during production
* the legal requirements for manufacturing an electronic product for sale (for example, relevant labour laws, safety regulations, and environmental laws)
* yield prediction, and how the manufacturer determines the yield prediction for a specific type of electronic product (for example Dynamic Controls compared with Tait Electronics)
* how yield prediction and quality control have been affected by social change (for example, impacts that people’s changing expectations about price, quality, eco-friendly and/or recycled materials have had on yield predictions and quality control mechanisms)
* how yield prediction and quality control have been affected by environmental change (for example, how the legislation intended to protect people and the environment has impacted on the usage and disposal of resources used in electronic product manufacture and how this has affected yield prediction and quality control)
* how yield prediction and quality control have been affected by computerisation (for example Computer Numerical Controlled machinery - CNC or CAD/CAM).

## Present your findings

Your assessor/educator will advise you of the format for your presentation.

Present your final findings, which should include the following information:

* Identify and describe at least two different types of electronic product manufacturing systems, and explain why at least two types of manufacturing systems are used in making different parts of an electronic product.
* Describe at least two of the categories of manufacturing techniques used in making an electronic product, and explain why the key manufacturing techniques are used in this manufacturing process.
* Discuss why two or more specific manufacturing techniques are used in making different parts of an electronic product, giving details of why different techniques are used.
* Create a flow diagram that shows an electronic product manufacturing process. Show how the various stages are linked using different symbols for the different technique categories.
* Describe the yield of a manufacturing process. Explain how the yield is determined within electronic product manufacturing, and discuss how yield prediction and its determination may be affected by social and environmental change.
* Explain the role of quality control in manufacturing an electronic product. Identify possible defects in electronic products and describe systems for identifying and responding to these quality issues.
* Discuss how quality control mechanisms may be affected by social and environmental change.

# Resource A

## Useful information

Types of manufacturing systems used in electronic product manufacture include but are not limited to:

* one-off custom manufacturing of a unique single product
* batch, intermittent, or short-run manufacturing – multiple copies of the same product or a single batch of a processed product
* continuous (often called ‘assembly line’) manufacture
* flexible manufacture and customisation.

The categories of manufacturing techniques may include but are not limited to inspection, transport, storage and operation.

Thenature of manufacturing may include but is not limited to consideration of product need; resource availability; political, social, and physical environments; and advances in manufacturing systems and techniques.

# Resource B

## Definitions relating specifically to the manufacture of an electronic product

Techniques used in electronic product manufacture:

* Inspection includes all of the different types of quality control inspection.
* Transport can include the transport of electronic products or electronics parts to another operator or the transport of raw materials from storage area to manufacturing/production to warehouse/distribution.
* Storage includes storage of materials, parts, semi-finished and finished electronic products, and waste.
* Operations can include marking, cutting, applying design, welding, and machining using a variety of pieces of equipment.

Yield prediction means determining the number of electronic products that is possible from the resources available, taking into account the expected wastage resulting from defects, faulty workmanship, and inefficiency.

Resources used in the manufacture of electronic productsmay include eco-friendly or recycled materials, machinery, floor space, storage, staffing and their skill levels.

Competitive manufacturing is a modern version of Japanese Kaizen ‘Lean manufacturing’ that includes JIT (just in time) materials or parts coming from the suppliers for production.

# Resource C

## Useful websites

<http://www.dynamiccontrols.com/>

<http://www.taitradio.com/>

<http://www.pwrtrnx.com/>

<http://www.adx.co.nz/>

<http://www.aec-electronics.co.nz/>

<http://www.bluewatersys.com/>

<http://www.enatel.net/>

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to investigate basic concepts used in the manufacturing of an electronic product, and create a presentation that demonstrates their comprehensive understanding.

# Conditions

Learners could gather and analyse their evidence independently or in groups, but they need to create their presentation independently, and will be assessed individually.

Decide on the format of the final presentation. You may wish to take learner preferences into account in deciding on the format.

# Resource requirements

Ensure that learners:

* know how to use a flow diagram to depict a process
* have access to information on:
	+ manufacturing processes
	+ quality control in electronic product manufacture
	+ yield prediction in electronic product manufacture
	+ social and environmental change that have impacted on yield prediction and quality control in electronic product manufacturing in New Zealand.

Learners will require access to the internet for research.

# Additional information

Visiting or talking to two or more electronic product manufacturers operating in different contexts (for example lean manufacturing, short-run manufacturing) may be helpful.

## Other possible contexts for this vocational pathway

Food products, car assembly, newspaper production.

# Assessment schedule: Generic Technology 91055 – Manufacturing an electronic product

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of basic concepts used in the manufacturing of an electronic product by:* describing different types of electronic product manufacturing systems

For example:The learner describes the manufacturing processes for a range of systems including at least two of the following: one-off custom manufacture, batch or short-run manufacture, continuous or ‘assembly line’ manufacture, flexible manufacture, competitive manufacturing or lean manufacturing that includes just in time (JIT), and indicates what type of electronic product each would suit.* describing categories of electronic product manufacturing techniques used in an electronic product manufacturing process

For example:The learner describes at least two of the following categories:* + inspection (including quality control and quality assurance systems)
	+ transport (of raw and/or recycled materials within the process)
	+ storage (including the items to be stored and types of storage required)
	+ operation (the resources required to operate the manufacturing process).
* developing a process flow diagram to communicate a manufacturing process

For example:The learner creates a flow diagram of an electronic product manufacturing process (using symbols to represent categories of techniques, such as storage and inspection), which illustrates the different stages of manufacture and indicates how they are linked.* describing the yield of an electronic product manufacturing process and the role of quality control

For example, the learner describes:* + how manufacturers predict the yield of an electronic product manufacturing process, taking into account the number of items that do not meet the quality specifications
	+ how quality control is used to meet manufacturing standards, and to ensure that electronic products with defects are not produced
	+ possible defects related to workmanship, consistency, and raw and/or recycled materials
	+ the quality control systems used to check the quality of the electronic products, from raw and/or recycled materials purchased through to final items
	+ systems for responding to fault analysis.

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of basic concepts used in the manufacturing of an electronic product by:* explaining why particular types of manufacturing systems are used in specific contexts

For example:The learner explains the manufacturing processes for at least two systems and the reasons for their use in particular situations. *Continuous or ‘assembly line’ production is used when the manufacturer is required to make multiple copies of a range of electronic products. This process is usually operated from large sized facilities, with more staff and specialised equipment involved to speed up the process without losing consistency, quality may become an issue because …**Lean manufacturing focuses on competitiveness, and materials or parts come from the suppliers just in time (JIT) for production ...** explaining key manufacturing techniques used in an electronic product manufacturing process

For example:The learner explains the techniques of at least two of the following categories: inspection (including key quality control and quality assurance systems), transport (including techniques for transporting raw and/or recycled materials within the manufacturing process), storage (including the key items and the types of storage required for these in the manufacturing process), and/or operation (including how the key resources are linked together to produce the electronic product).*In continuous manufacturing, larger storage areas may be required for materials as more electronic products are being produced, and so greater quantities of materials may need to be held for a time in a storage area, until production begins. Some materials may need to be kept in particular environments, for example with constant temperatures to ensure they do not deteriorate before manufacture …* *Lean manufacturing would not require much storage space as materials and parts are supplied JIT for production …** explaining how yield is determined and how quality control is managed within an electronic product manufacturing process

For example, the learner explains: * + how yield may be calculated*. At XYZ Electronics (refer to my field trip notes) they calculate their yield in their computer system (CNC, CAD/CAM) that shows ...*
	+ how quality control may be managed. *In this system, quality control is the responsibility of each worker. There are incentives within teams and the goal is minimum faults, defects and waste. There is a test and quality check before packaging and any goods not working, defects, and waste can be tracked down to the materials or worker responsible. The worker or suppliers are notified and extra training is offered if required, and suppliers are monitored more closely …*

*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of basic concepts used in the manufacturing of an electronic product by:* discussing why particular manufacturing techniques are used in electronic product manufacturing

For example:The learner discusses the reasons for choosing particular manufacturing techniques in the context of specific processes for at least two systems.*An electronics technician involved in lean manufacturing would focus more on quality, and it’s possible to operate in a small to medium sized facility with specialised equipment …* *However, in continuous production much larger numbers of electronic items are manufactured. There needs to be adequate storage space to accommodate materials, parts and finished items as well as the range of specialised machinery likely to be used …* * discussing how yield prediction and its determination, and quality control mechanisms, may be affected by social and environmental change

For example, the learner discusses:* + ways in which yield predictions can be determined by using inputs, processes, and outputs
	+ the role of computer systems, and how these have improved the efficiency of planning production lines and their yields
	+ the efforts that certain electronic product manufacturers are making to reduce their environmental impact by reducing waste and energy consumption, and by increasing recycling, as well as the success (or not) of their strategies
	+ the impact of customers wanting eco-friendly and/or recycled electronic products, and the effect that these choices have on waste
	+ the impact of consumerism on the life expectancy of electronic products, and how this has impacted on yield determination and quality control mechanisms
	+ legislative requirements for social conditions, such as labour laws (e.g. in terms of hours of work, rates of pay, safety considerations) and how these impact on yield prediction and quality control (e.g. cost of electronic products manufacture)
	+ legislative requirements that relate to environmental issues and how these impact on yield prediction and quality control (e.g. the impact of the Resource Management Act on waste management and disposal requirements).

*The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.